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STRUGGLE

BY

DR. EMANUEL LASKER

1907

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PREFACE

This book, though it deals with laws governing struggles in general, is the outcome of reflections upon the meaning of the approved principles of the struggle on even terms between two brains called chess. The result of contests is on the chessboard much more clearly discernible than in other combats, on account of the checkmate that admits of no obscuration. And chess offers so many opportunities for study, its theory is so well tested, that it is an unrivalled educator in strategy. Hence, my activity in chess during the last eighteen years has been a not inconsiderable advantage in my endeavor, extending nearly as long, to express the strategic rules valid on the chessboard in terms so general as to apply to any of the combats in nature.

New York, January, 1907.

EMANUEL LASKER.

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THE PROBLEM

It is an old reflection that life is a struggle. Darwin has expressed this idea more profoundly. He proved that the race, nay even the individual, is the product of the life struggles of its ancestors. The riddles of the cosmos can therefore be solved in one way only; by investigating the laws and principles which determine the course and the outcome of struggles.

However, the book of the strategy of contests is yet unwritten. There are many who would even deny the possibility of the existence of such a science. Mystic conceptions of the nature of combats are as dominant as in the times when it was supposed that victory was achieved by the aid of Athene, when before important decisions the advice of the gods was asked, when their good will was solicited and after victory was secured thanks were offered by making sacrifices of various kinds; and where men thought that neither reason nor justice but the dictates of an autocratic power governs destinies.

The idea of the dependence of human fate upon an unanalysable force has brought immense suffering to humanity. The pages of history and contemporary life are full of illustrations. At the time of the Solstices each family of the old northern races sacrificed its first born to the sun believing that by such a great sacrifice the sun would be induced to return on its course and to bring warmth and harvest. It was only after many thousands of years, when the Christian missionaries showed that the sun comes back unsolicited that these sacrifices ceased. And when they explained the sacrifice of

Jesus, Yule Tide became Christmas. The poetical dress of the Yule feast still exists. Its terrible purpose is now forgotten. A few phrases, a few old customs and, if we dig deep, a few superstitions serve to remind us of the sacrifice of human life made at Yule Tide to the sun and the god of harvest.

When humanity was in its infancy it conceived all the forces upon which the course of human life depends as man-like personalities. These were the gods, the fairies, the elfins, the witches, ghosts and goblins of our ancestors who resided in the air, in fire, in water, in woods and in the imagination. There they played many fine games, loved and hated and struggled with each other like men, until a strong enemy, growing up by slow degrees expelled them into fairy land. This destructive foe of arbitrary power is an instinctive tendency common to all life out of which grew our ideals of justice.

A just judge must not be moved by inclinations or prejudices. If he be infinitely just, it would be better for him not to harbour likes or dislikes whatsoever. For after he has heard the evidence, there can be no doubt as to his judgment. Every human being has an instinctive sentiment destined to play the role of such a judge. Even children and the intellectually lowest races, although not competent to practise justice, recognize it. Justice meted out by the father elevates him in the eyes of his children to a king whom they love and adore. Every unjust action by him produces fear in them and lowers their respect.

Who tells children what is just and what is unjust? And how is it that they have an unflinching sense of justice? Thousands of generations have contributed towards the development of an instinct whose germ is the sense of equality such as is expressed by the golden rule: "Do unto

others as thou wouldst others do unto you." In olden times a few kings practised justice, for instance, the wise and mild Hamurabi and Abraham. That they were just, even in anger, excited the admiration of their contemporaries. The Bible says of Abraham that he was peace loving but strong in war when defending a just cause. In those days of autocratic kingship the common man did not know how to practise justice, nor demanded it as a toll due to him from the rulers, until Moses on Mount Sinai announced the Ten Commandments. Their essential meaning is that they give precepts for just living in the daily intercourse of average men. Great emphasis is laid throughout the Old Testament on justice. We are told often that "God is One, all Powerful and Just." This word of the justice of God was to the oppressed Israelites a call from fairy land; the promise of a happier future.

Ideas of justice slowly grew among the Jews as is abundantly shown by the equalising laws of the Talmud and the practise of charity imposed on them in the law of the "tenth."

Then came Jesus of Nazareth, and St. Peter hurled the hate devouring torch of his teachings among the nations. The justice that exacts "an eye for an eye, and a tooth for a tooth" was repugnant to Jesus. Such justice might be applied among perfect beings; but among frail and erring men charity becomes a necessary adjunct of justice. Charity in the wide human sense is the motif of the New Testament.

In the sermon on the Mount, Jesus said "Love your enemies. I say unto you that ye resist not evil." On the tempestuous sea He said to the sailors "Why are ye fearful, O ye of little faith." He promised eternal happiness to those who act right to men, damnation only to those who act wrongly towards their kind. These admonitions have never been

understood literally. Christians have killed their enemies in battle. Indeed, when they have been most devoted to their religion, as a few hundreds of years after its foundation and in the times of the Crusades, they burned thousands at the stake who belonged to a minority interpreting the Bible in a manner slightly different from the governing belief. It would not be absurd to imagine that such acts might be just; but it would be doing violence to the word love to suppose that they conformed to the precept "Love thy enemies." Therefore it is evident that the words of Jesus are not exempt from the necessity to which all language is subject to be taken allegorically. And it is not difficult to discover their exact meaning. It is impossible that his demands should be contrary to the principles of charitable justice, and even such justice must at times punish. Punishment might be actuated by the desire to improve, but it is contrary to human nature to love injustice. Hence "Love thy enemies" can only be followed when the enemy is acting justly. Then it can always be followed; even the criminal may love his just judge, nor do we hate our conscience.

The allegory "But whosoever shall smite thee on thy right cheek, turn to him the other also," in common with other allegorical injunctions demands extraordinary mildness and reticence before an accusation is made and an act of punishment or vengeance is performed.

The words pertaining to faith have been misunderstood oftenest. Evidently no one can force himself to believe what is not in his nature to believe as little as an apple tree can force itself to bear roses. It would therefore be most unjust to demand faith and to threaten with eternal damnation those who cannot comply with the demand. Such procedure would be far from the mildness preached

by Jesus. The fishermen were asked to have faith in spite of the raging tempest. We may presume then that the test of faith comes in the midst of difficulties and misfortunes. Hence faith is a belief that the forces of life act not blindly but are, manlike, subjected to the working of a principle of justice. Who has faith does not fear. The reward for the faithful is happiness. It is impossible to understand heaven and hell as having physical existence in space but they may exist as forces acting on the mind. Nor is this interpretation in any way opposed to the biblical sayings, for in Jesus' description of the kingdom to come happiness is promised to the righteous who have treated even the poor and lowly with justice and charity. Heaven and Hell lie therefore in one's conscience.

To say that the above interpretation is the only one compatible with logic and the spirit of language would be utterly untrue. In fact, the latitude of the interpreter is considerable. But there is only one understanding of the Bible which will enable men to follow its precepts while fighting life's battles wholeheartedly. And from this interpretation valuable advice can be gleaned by the toiler.

Hope and Faith, such as we have stated it to be, perform a necessary and valuable function.

When our life presents hardships, when we cannot master the difficulties, and doubts of our ability discourage us, hope tells us to do our best and to wait. When we are in the presence of immense forces and a sense of our insignificance assails us, faith whispers into our ear not to fear injustice. Hope and faith still the heart beat when will and reason cannot overcome obstacles, and therefore doubt and anxiety make the heart tremble.

No being is born without hope. Hope is the propelling power of all life. Even the lowest animals live cheerfully, though pain or death may

immediately overtake them. Ignorance does not disturb them. But there are many men without faith. Faith is courage after action, and therefore strengthens the individual to further enterprises. It brings peace. In the evolution of mind it is the youngest member of the family of sentiment. It is the conviction of the justice of all that happens, the expression of confidence and trust. Fundamentally, it is built on the idea of justice. It follows therefore that only those who have sentiments of justice can ever hope to attain the blessings of faith. Who has no faith cannot obtain it by a mere command. It must grow. It is nourished by experiences gained in enterprises whose outcome we cannot fully determine; in sailing the ocean, climbing mountains, in searching after truth, in the struggle against evil social forces, even in boarding the express train, or the Atlantic liner.

Let us for a moment consider the position of a man who has no faith. To begin with, the extent of his enterprise is dependent upon his knowledge, and naturally he can only move in a small circle. Met by a great force whose power he cannot comprehend or command, lack of faith compels him to search continually for knowledge which he cannot obtain. Fear makes him needlessly wretched, his spirit of enterprise is weakened, and his abilities do not reach their natural development.

What is ordinarily termed faith is entirely different to our definition. The common notion of faith is the expression of a wish for the greatest happiness even though we have done nothing to deserve it. Those who possess it have moments of ecstasy; but like the opium eaters they have to purchase their happiness by extreme suffering.

What faith promises them is such as would fill the imagination of a child with extreme happi-

ness; for instance, eternal joy to themselves and suffering to their enemies. Such faith instead of helping us to love our neighbors can only end in making us pity, despise and hate the faithless.

The faith, the trust that God who gives the sparrows food will not forget men must however only be called to aid after will and reason have done their utmost. The sailors who forget their duty perish. But when they have done their best, then they should have faith and not fear. It is to the worker that faith, the harbinger of peace, is a real blessing. But those who look upon faith as an end in itself without using will and reason to the utmost extent do not satisfy the demands of justice. For they leave to others to do their share of the work for the maintenance of humanity. They do not earn their daily bread by the sweat of their brow.

After Jesus was crucified many tried to explain the ideas of his picturesque and allegorical language. The erring brain of man has propounded thousands of interpretations. Finally the simple and beautiful teachings of Jesus were clothed in a mystical dressing. It was said that only the faithful can participate of the grace of God. But is not the whole world proof and bearer of the grace of God? Immense suffering has been caused by this mystical conception of faith.

Savonarola was the pioneer in the struggle against mysticism. He was a truthful follower of the teachings of Jesus.

When the hostile priests burned him at the stake and a boy fed the fire with a stick of wood, Savonarola exclaimed, "O sancta simplicitas." It is marvelous that a man tortured by flames of fire had such a sense of charity and of justice as to accuse the boy, his would-be tormentor, of nothing more than simplicity pronouncing it sacred at the same time.

From the ashes of Savonarola there grew other fighters. Many fell in the struggle, but others always took their place and held up on high the light of knowledge. It is our duty to continue this work and to accomplish it

In olden times when the continents of the earth were little known, miraculous islands were thought to exist and the imagination peopled them with strange and terrible monsters. Now we have discovered all parts of the world except the two poles and examined its products, its uses and its dangers. In former times humanity profited by the resources of nature very little, now an abundance of crops, of animals, of metals, of labor-saving engines is produced. Acquaintance with reality has enabled us to do this. It is even so in the world of ideas and sentiment. There, also, are imaginary monsters, frightening the timid, but revealing their impotency to the courageous searcher after truth. And the downfall of these monsters will be as great a benefit to humanity as the extension of our knowledge in geography has proven to be.

It is the mystical conception of life that has to be contended against. The riddles of life being solvable only by a study of struggle, the mystical conception of contest must be assailed. What is struggle and victory? Do they obey laws that reason can comprehend and formulate? What are these laws? That is the problem!

STRATEGY

In the science of war a distinction is made between strategy and tactics. The military strategist orders the execution of movements and manœuvres, the tactician follows the command without searching for its reason. The tactician solves the problems set by the strategist. The strategist must know the military situation in its entirety, not so the tactician. For him only those circumstances are essential that may tend to lighten or to make more difficult his special task.

Important as this distinction between military strategy and tactics might be, it is not fundamental. For the distinction is only one of degree, it is founded merely on the magnitude of the tasks set.

War is a very interesting struggle, but by no means the only one of significance in the life of humanity. The world, in its largest as in its smallest parts, is full of struggles. To prove this, it is only necessary to extend the conception of struggle to its natural bounds. A struggle arises always when something that has life desires to attain a purpose against resistance.

Words travel in the brain in fixed channels so that he who wants to express new ideas is obliged to coin new words. A struggle may be therefore here called a "machee" and "alive" in the above sense, be everything that is capable of development and regeneration, such as an animal, a plant, a race, a nation, a cell, an organ, a language, a sentiment, an idea and many other things.

Many questions may here be asked. What is will? What is a purpose? etc., etc. These problems have been put two thousand years ago and

a satisfactory solution has not yet been found. Here, no attempt at logical hair splitting will be made. In the future some philosopher may perhaps arise who will examine these questions anew and lay the foundation for an absolutely rigorous theory of machee. Now, no more will be attempted than to make accessible some considerations and reflections which are useful for the practical purposes of life. And the author tries to attain this end by the least circuitous road.

We shall understand the strategy of a machee as the totality of considerations that aid in the explanation of, and in foreseeing the happenings of a machee. Tactics is the strategy of an episode of the machee.

In every machee there are centres of effect, such as soldiers, guns, cannon, sabres, ships, etc. in war. They will be called the "stratoi" of a machee. Each stratos has, as a rule, several effects different in kind; effect is therefore generally a multiple quantity. The unit of each effect that may be produced in the machee may be called a "jont." The effect of a stratos is consequently a combination of various jonts.

To give an instance, a gun in the hands of a soldier can throw projectiles, which may pierce earth works of a certain thickness and may put exposed men hors du combat. A gun has therefore a piercing effect of a higher or lesser degree, by means of which it can put men out of battle under various circumstances. A gun usually has a bayonet and sometimes it has been used as a club, as in one of Blucher's battles. The gun represents therefore three different kinds of effects, or jonts.

Stratoi move and act in an environment peculiar to the machee, which we shall call the "field" of the machee. The name calls forth a picture of an extension in space, but the machic field very

often has non-spacial properties. In the machee of two candidates aspiring to the same office, the "field" is composed of the traditions, the power and the uses of this office and the ideas that the people have of these matters. The field represents the totality of the circumstances of the machee that cannot be influenced by the stratoi. But, it is, nevertheless, a most important factor in determining the course and the issue of the machee, as it is evident in regard to the battlefield.

The first and most important objection that could be raised against the attempt to found a science of machology is the infinite variety and apparent indeterminateness of machic events. When a system of physical bodies is acted upon by forces, its ensuing movements can be determined by d'Alembert's law. If the position in space and the motions of the particles of the system are known at any one moment and the forces acting upon it in the course of time are given, the state of that system during all time can be definitely ascertained. But it is different in a machee. It is sufficient to consider a game of chess in order to show that from the same situation of the stratoi the machee can follow varied courses. One might think that on account of this indeterminateness a machee would brave all attempts to subject it to law and reason.

However, such an objection would be based on a fallacy. When chessplayers of little skill are opposed to each other, it is evident that their choice of moves is somewhat restricted on account of the purpose that they have in view; the checkmate,

Where a mediocre chessplayer sees ten moves to continue his game, a master may see only two or three. He discards the others as not of sufficient merit. The further the master progresses in skill and foresight the more is he restricted in his choice of moves. It is very similar in other machees. If

a mediocre pianist plays a piece before a musical audience he will imagine that he is able to execute his task in a variety of styles. But for Rosenthal or Paderewski only one way of rendering the piece will exist. The higher the class of the artist, the less is his liberty.

We may, without a breach of any logical law, conceive the process of the growth of perfection continued indefinitely. It is therefore not absurd to assume the possibility of the existence of a perfect strategist. Such a being which can only exist in the imagination, never actual in the flesh, has no liberty whatever. Its desires to attain a specific object with the forces at its command, struggling against obstacles, causes it to use his infinite skill, insight and strategic wisdom and thus propels it into a line of action that every other such perfect strategist would follow. Whatever its course of action may be, it is determinate.

Ideal beings of this perfect type will be called "macheeides." A strategic action of a macheeide will be called "eumachic," any other strategic action "amachic."

If the course of a machee is eumachic, it is uniquely determined.

But in this reflection we have silently admitted the truth of a supposition that deserves illustration.

Evidently purposes can be attained in a variety of ways, just as in business an article may be bought for a large or a small sum of money, or at immediate or later delivery. But we shall designate him as the best business man who concludes his transactions to the best advantage. After a series of such transactions his advantage will finally be measured in money.

In every machee existing in nature, a similar parallel may be drawn. In battle, for instance, the general shall perform a certain task in such a man-

ner, that, finally when the balance is drawn, his loss in military values (stratoi and jonts) is as small as possible.

Something exists, consequently, in every machee that plays the same part in that machee as money in business. In the struggle of living beings that thing is called vitality. We shall name it the "energy" of the machee.

Macheeides are therefore, according to their nature and definition, infinitely economical with the energy at their disposal. An action that wastes energy is amachic.

Macheeides exist in nature. Probably the atoms may be conceived as macheeides, inasmuch as they obey the principle of least constraint by Gauss and also other principles which imply that a quantity—the energy of the machee of atoms, as it were—is in all actual movements the least possible.

Undoubtedly the instincts of plants, animals and men are macheeides. The involuntary actions of living things against small irritations that attack them are to a high degree, we may say infinitely, economical in regard to the vitality of their species. Many are the experiments that are in accordance with this proposition. But let us illustrate our meaning by a few well-known facts.

The race never makes an exertion unless resistance forces it.

When resistance ceases, the organ, whose function it was to combat it, is given little nourishment, becomes finally dwarfed and is used for other purposes.

No individual, not even a single cell is allowed to fall in life's struggle but an effort is made to compensate the race. Before individuals die of infectious diseases, that are a threat to the race, they struggle in fever and weaken their assailant who in time loses its virulence. Animals flee before

superior force, but when they are wounded they furiously attack the enemies of their race before they die, although they know that for themselves they have nothing to gain by their act of vengeance. And a mother courting death fighting for her babe is really fighting for the race.

The course of the development of an embryo of a race changes very slightly in the progress of time. In each generation that process is very nearly the same as it had been in the last, and so on through thousands of generations. The part that the last generation takes in varying this process is exceedingly small. Very little of the experiences and adaptations of the last generation is added to the life of the embryo. This having always been so, it follows that the embryo must pass through all the steps of development of his race, before he can become a member of it. This is Haeckel's phylogenetic law which very likely can be extended. For it is probable that every individual act of seeing, smelling, tasting, hearing, feeling and thinking in the short time of its generation passes through all the stages of development through which the senses and the act of thinking had to pass before they became what they are. I have made observations on the process by which a chessplayer decides on his move. Even excellent chessplayers act as they did when they were the merest tyros, if they are forced to move so quickly that they cannot finish the process of strategic reasoning through which their brain passes. Their first impulse is to make an arbitrary, usually senseless move, the second impulse shows already a slight progress in thought and so on through the whole scale of their chess development.

But it does not need the aid of experiment to demonstrate the above assertion. The consumption of vital energy used for the change of instinctive

life processes is now and always has been a minimum, and from this the philogenetic principle of all life functions, as of life itself, follows as a logical necessity.

The capacity of a stratos to serve the purpose of the macheeide depends on two different things:

1. On the intensity of its jonts in the various positions that the stratos may occupy.

2. On the mobility of the stratos, or the ability of the stratos to adapt itself to varying circumstances, or its ease of transition from one task to another.

A man provided with a gun and bullets who lies behind a sandhill and aims his shots at immobile or mobile things or persons represents a jont of the same kind as a machine gun that dominates the same space. But the intensity of the latter is much greater. The fire of a battery is not influenced by the loss of its horses, but its ability to adapt itself to circumstances is much decreased thereby. A man exposed to the fire of the enemy and who lies on the ground can be less easily hit than a man standing upright. He therefore absorbs more fire than the latter. This jont of the man, other things being equal, is inversely proportional to the surface that he presents. A man who in daylight stands upright on the field, can walk and move about more readily and can use his sight to better advantage than a man crouching on the ground. Therefore the adaptability of the former is larger than that of the latter. An artist has the more adaptability or what is generally described as versatility, according to the number of varied tasks which he can successfully perform. The white blood corpuscles hurl themselves against bacteria or matter that enter into the blood. They attack the intruders, struggle with them, and finally, if victorious, swallow them. The number and the energy of the white corpuscles in the blood represent a quantity. But the capacity of the blood,

after an invasion to generate that particular serum best suited to defend the body against its intruder, is proof of the immense adaptability of the blood.

These various examples illustrate what the expressions "intensity of the joint" and "mobility" or "elasticity" or "inflexibility" or "adaptability" of the stratoi are meant to designate.

We shall call the adaptability of a group of stratoi their armoostia.

If a group of stratoi threatens another the latter has no choice but to parry or to permit the enemy an advantage. If, for instance, in an encounter fought with swords, a man strikes a blow, his opponent cannot remain inactive without suffering. He may jump backwards, move his head or body out of the way or catch the blow with the blade of his sword, but in any case he is forced to do something that we call "parry" or suffer at least a partial defeat. Similarly, if a man assumes a position of readiness from which he might successfully strike various blows according to his choice, his antagonist must assume a position to prevent those threats from being executed.

A prevented threat is called "pressure." As long as the threat exists, a part of the hostile energy must be spent on hindering its execution. The liberty of choice of the enemy is decreased by the pressure exerted upon him.

To find the strategy of the machaeides is frequently a task of extraordinary difficulty. But in a few typical cases we can discover the eumachic manoeuvres. And later on we shall see that we can demonstrate whole classes of possible manoeuvres as amachic.

A small force which is being approached by a very large force must move in the direction of least pressure. Any other manoeuvre would be amachic,

because the counterpressure of the small force is generally negligible and it must therefore be its strategy to sell its life at the biggest price. It executes this plan by flying in the direction of least pressure, since then the future threats of the powerful opponent are a minimum.

If the small force is in a position of minimum pressure, it must stay where it is. Such a position is an ambush or a fortress, and the small force will be ultimately lost there unless support arrives in time.

It may sometimes happen, that the small force exerts a very strong pressure on its powerful opponent, by being able to rapidly attack a vital organ. In that case the small force will move in the direction of the smallest difference of pressure.

To be able to literally follow this principle, it is necessary to have means at hand for the measurement of pressure. Generally it will not be difficult to approximately indicate the various threats and therefore also the implied parries in which two opponents encounter each other on each point of their machic field. The pressure on a point can be quantitatively measured by finding the exertion that one of the parties must make in order to assail it in a eumachic manner. The greater the necessary exertion, the less the pressure on the point.

If A is a force of small intensity but large armoostia and B conversely one of large intensity but small armoostia, it is the strategy of B to expand its pressure equally over a coherent region of the field so that its pressure is everywhere at least equal to that of A.

The largeness of its armoostia enables A to concentrate its force quickly upon any given point. Hence B should never permit its pressure on any point of the region that it desires to dominate, to be less than the pressure of A. A reverse would

otherwise be probable. If the ponderous B would assail the mobile A directly, it would make a vain effort, for A will have changed its position at the decisive moment so as to deprive the attack of its incisiveness. It must therefore be the object of B to limit the armoostia of A by subjecting A to pressure which it cannot evade. A coherent region of pressure, such as a ring, would be preferable to any other, as it would leave no loopholes for escape. By contracting the region of pressure A may finally be forced to battle and be annihilated.

All this is true in whatever form the machic field may present itself.

A very important particular case of the above is that of a force A of stratoi which has a very large armoostia for defensive purposes but none for aggression. Such force is best established in a portion of the field where changes in the situation of the machee are not desired and where an attack is apprehended. When the moment of attack draws near, sufficient pressure should be put upon the field where A is stationed to make it inadvisable for B to attack. It will then be the best policy of B to concentrate his threats upon a point of A so as to force a defensive manœuvre that will decrease the armoostia of A. After the armoostia of A is sufficiently lowered by this process, an attack by B might be undertaken and will not miss the point. If B has more important tasks on hand, or if it is impossible to decrease the armoostia of A by force, B is obliged to assail the enemy from a different direction.

For example, on the battlefield we have sand walls, ditches, wire entanglements defended by a small force but whose approaches are exposed to strong artillery fire. In chess a well supported chain of pawns has the mobile and defensive prop-

erties above described to A. In law, the cross examination of an unwilling witness is an instance.

The case where A has a large armoostia for attack is illustrated in war by cavalry, torpedo boats and submarine vessels. In the struggle of the races a mosquito is a very good example of such a force. In chess especially the knights and bishops play the role of an aggressive A.

If A has a slightly larger armoostia than B and otherwise approximately the same intensity of effect then it is best for A, to avoid engaging his forces until he has profited by his superior armoostia.

If A advances to meet B, the circumstances to which A can adapt himself more readily than B, would not occur. But if A keeps at a distance from B, the pressure of B on A is very small and A can readily and with ease assume that formation of his forces which would allow him an advantage over B. Thus B would be obliged to make exertions to assail or to evade A; in either case a disadvantage.

As an instance we may think of the combats between cavalry and infantry as occurred in the past. But almost in every machee instances will present themselves to us.

Let there be three groups of stratoi, A, B and C. A and B belong to the same party, C is their opponent. A is equal or even superior in force to C. Let B have hardly any armoostia (a chained giant, for instance). It will then be the best strategy of C to attack B in its most vulnerable points or at least to threaten to do so, and it will then exert a tremendous pressure upon A.

This type is very important, as its influence makes itself felt in every situation of a machee. For each force contains always groups of relatively large and others of relatively small armoostia, such as A and B.

The demonstration of the proposition is clear, when we consider, that the stratoi of small armoostia have in proportion to their capacity for serving their cause only little power of resistance and that they therefore invite the attack of their opponent. According to the definition of a macheeide it must neglect no opportunity to gain machic advantages. In the same way A must not permit the time when C attacks B to pass by unprofitably. Therefore A will rapidly concentrate his forces upon C, more particularly upon the most mobile forces of C. A battle between the most mobile parts of A against the most mobile parts of C will ensue, and C will in this be defender, but aggressor against B. The parts of A and C that cannot very quickly reach the scene of action will in this fight be hardly more than spectators. The macheeides can almost leave them out of their calculations.

The types above enumerated occur rarely by themselves, but jointly they occur in each machee and in each situation of a machee. The manœuvre of the macheeide will accordingly be such as to express all the various elementary strategic principles at once. Mathematically speaking, its manœuvres will be the resultant of the different simple manœuvres that it would choose, were the types of positions as simple as they were described above.

We are therefore able to sketch the course that a machee between two macheeides will follow, in a general manner.

The group of stratoi that in proportion to their capacity have small armoostia will be the objective point of the opponent's attack. In a naval battle, for instance, the men-of-war, on which the cannon fire has begun to tell by disarranging their machinery or in making them in some other way less capable of swift motion, will attract the fire of the opponent. The points subject to small hostile pressure,

but whence comparatively strong effects are possible, are particularly suited as resting points for stratoi. Other places will generally be points of transition for stratoi. And the larger the armoostia of a stratoi, the more pressure it will be able to withstand or, as we might say, to absorb. In case of an attack by superior force, the line of retreat will be that of least pressure. Stratoi of large defensive armoostia will be used to form a coherent wall that can only with difficulty be penetrated, such as a ring, a line, a shield or skin. Its function will be to minimize the effect of the mobile hostile forces and to form in its rear a space of small pressure that is very apt to serve as position for strong stratoi of small armoostia. Stratoi of large aggressive armoostia will attempt to make a breach into the enemy's wall. We see all this exemplified in naval warfare. The armour is the wall, the cannon balls are the stratoi of large aggressive armoostia. The position of the cannon on each ship and of the ships in their formation is chosen with regard to above rules. In the body of an animal the most valuable organs are situated in the points of least pressure. But we could multiply the examples a thousandfold.

If the hostile armies of stratoi are at a large distance from each other, the macheeide, if unable to increase the number of its stratoi and jonts, will be entirely devoted to improve its "organization" and to impede that of the enemy. The purpose of "organization" is to increase the armoostia, for instance by seeing to it that the stratoi do not obstruct each other but have a free field for their effect. Its aim is also the formation of a wall that has to serve as the most advanced coherent line of defence against raids of the most mobile stratoi of the enemy. When the hostile forces approach each other the task of organization is over-

shadowed in importance by others. But even then it is by no means negligible. On the contrary, amid the clash of arms the process of organization is quickly proceeding to furnish lines of reserve force when they are most needed. And a process of organization, reorganization and disorganization is going on during the whole course of a eumachic machee.

It is impossible, without the aid of the principles that will be discussed later on, to give a more detailed and accurate description of the machic process, but even the outline of it as given here is capable of teaching many lessons. For it is on account of their universal applicability and the ease with which they can be applied, that these maxims are valuable to the average man. Whether a man is occupied in business, or study, or art, or social life, or play or with competing in a contest of grave consequences, it will generally be an easy matter for him to determine the field of the struggle and the stratoi, and to obtain at least an approximate idea of their effects and jonts, their armoostia and their pressure. And thus by following the principles laid down, his action, though he study the situation very little, will at least approximate eumachic action to some extent. Ordinarily, men act very foolishly in machees that they have examined little. They make the most elementary mistakes, in direct opposition to the above common-sense rules.

To find examples to illustrate what has been said hitherto we need only look at random into the current of life. In fencing, it is clear that the blade of the weapon serves as wall, that the initial position, which the fighters usually assume, is intended to be the position of largest armoostia. that eye, wrist and foot are valuable stratoi whereas

body and head demand protection. The strategy of macheeide fencers is difficult to determine, as it depends each instant on the mobility and the state of fatigue of eye, wrist and foot, on the motion that the weapon and the wrist is actually executing, on the exertion necessary to change those motions and on the situations of exposed points. To examine all this accurately one must study the physiological laws of action valid for the eye, the wrist and the feet. After this knowledge has been attained, the theory of fencing reduces itself to a mere intellectual labor, which may be symbollically expressed by a kind of chess game, in which the actions of the pieces imitate the actions of eye, wrist and feet etc., in their field. To acquire skill in fencing it is necessary to "train" the brain, the eye, the wrist and the feet for rapid and accurate execution of their various tasks, or otherwise one would be able to tell how to fence but unable to execute one's strategy.

It is very similar in boxing. Here the fist is seat of the attack, the bones of the arm form the wall; the weaknesses are a certain point on the chin, nose and eyes. Eye and foot are again valuable stratoi, as also the muscles of the arm. Some other muscles, the weight of the body and finally the mobility of the head are of importance. But the wrist plays here only a small part.

Or let us consider the machee of a business man.

The profit which his activity or his wages bring, the work or the money that they save to society, represent his stratoi for aggression. The advertisement in every shape is an army of very mobile stratoi penetrating into the regions of large pressure. His capital and his credit are his armooostia, as they enable him, to attack a variety of tasks. His wall against intrusion is mainly his bookkeeping, the "system" that he follows, which enables him to detect the most mobile enemy of the

business man—error and obscurity. The strongest and most aggressive hostile strato are better or cheaper merchandise. Other enemies are tasks that he has to solve, such as the getting of orders, obtaining payments from his debtors and transporting his merchandise. The macheide business man solves these tasks according to the principle of economy that will later be discussed. The machic field is the consuming and purchasing public, its laws and the buying power of money.

THE PRINCIPLE OF WORK

To the extent to which the stratoi accomplish effects on parts of the machic field or destroy or absorb effects of the enemy, or reduce the hostile armoostia by threats, or promote the common aim of their army in any way, they execute "machic work." This "work" is a quantity; it is not very difficult to determine, at least approximately, its magnitude. It is true that the machic work of stratoi is a very much more complicated conception than that of the machines or physical systems. Work in its physical significance is a fundamental conception which the physicist knows how to measure, whether the form in which it appears is mechanical, or thermal, electrical, elastic or chemical. In machees the work, as defined above, appears in an infinite variety of ways. In war the number of hits of a rain of bullets count as work. And if the enemy by a threatened fire is restricted in its mobility, the work is potential and its value may be found by determining the loss that the enemy sustains in its diminished effective power. In boxing, the work accomplished can be measured by the fatigue produced by the blows on the bodies of both antagonists; to be accurate, as the difference of the fatigue of each. And since every muscle has a different value for the boxer—all muscles drawing upon and therefore fatiguing the heart—the fatigue in its resultant effect is, as mathematicians would express it, a linear function of the fatigue of the various muscles of the body. In chess the capturing of the hostile men, the domination of the flight squares of the opponent's king and the attack of squares where pawns advance to queening count as work. The values of these

categories of work change with the position, but only very slightly. From these illustrations it becomes fairly evident that to find an approximate estimate of the magnitude of machic work, is a task that is always possible though it may be complicated, and that the approximation with sufficient labor may be extended indefinitely.

The success of an army of stratoi depends on its "work." They must accomplish effects in order to gain the victory by force. This is a truth which appeals to our reason with axiomatic force, but, strange to say, there have been times when it was disregarded. Jesus said "By their fruits ye shall know them," and he pointed out that the goodness of a man must not be gauged from the intentions that he professes, nor by his own estimate of himself, be it high or low, or even by the judgment that others form of him, but by such of his actions as are the outcome of a conflict in which his sense of justice and charity triumphs over sentiments of a lower order. Even in warfare the principle of work has not always found credence. At the time of Frederick the Great the aim of the generals was to gain victories by subtleties in strategic manœuvring. At the battle of Leuthen the Austrians, ninety thousand strong, many of whom had not fired a shot, fled before thirty thousand Prussians, because the Prussian cavalry was in their rear. The belief in "positional advantage" had degenerated into an unreasoning superstition. The value of strategy, which undoubtedly exists, had by a series of brilliant strategic successes come to be overestimated. "Manœuvring" as opposed to a straightforward and simple striving for machic effects can only be successful, as a stratagem, against an opponent who believes in it. But let those methods be adopted against a Napoleon, and the results cannot be doubtful.

Another instance is Rococo.

It is perhaps in the nature of the human mind that a mental force, like a pendulum, once it has begun to act does not immediately lose its energy when it has reached the point of equilibrium. The retarding force must be given time to counterbalance the driving force before the point of rest is reached. And then the process repeats itself in the reverse order. In art such a struggle between the thing to be expressed and the form of expression is continually going on. In the Rococo period the outward shape, in which its literature, its paintings, its music and its other manifold works of art appeared, was original, clever and, in a certain sense, beautiful. But they were void of content and import and from this lack of proportion failed to sustain or even excite the interest. At the present time a work of art must convey a message and it must do so in terms simply and directly appropriate to the subject matter. It must touch and move.

The genius of the macheide is the capacity to perform, with its army of stratoi, a maximum of machic work. The macheide therefore, in every moment and with every manœuvre, strives for results. If, for instance, the weaknesses of the opponent are great and his armoostia is consequently small, the macheide will force him into energetic action. And if the opponent holds a strong position, the macheide will weaken his armoostia by threatening effects. The manœuvres of the macheide are in every case calculated to achieve machic work.

The magnitude of the work that a group of stratoi can perform under all the varying possible conditions that may present themselves in a machee, is an index of the machic value of that group and may briefly be called its "value." We

do not do violence to the word by this definition. Although the world does not like to lay down an immutable measure when the value of persons and institutions have to be determined, who would dispute, that the only fundamentally objective manner, to fix values for things. is to denote them as equal to the capacity for doing work that these things possess?

The work obtained from a group of stratoi during the machee by the macheide, is in proportion to the value of that group. This proposition is capable of rigorous demonstration. Let us suppose that at the commencement of the machee, the enemy being far away, the macheide be given the choice to incorporate one of two groups of stratoi, A and B, into its army. It will undoubtedly decide in favor of the group of stratoi possessing the greater capacity for work, since A and B are of use to it only in so far as they aid in the solution of machic tasks. But the macheide cannot be mistaken in its forecast, for it could, if it wanted, predict the whole course of the coming struggle. Hence it will in that struggle derive the greater advantage from the group of stratoi of greater value.

We shall call this proposition the principle of work or the principle of value.

In order to obtain the largest results from an army of stratoi a task of minor importance should be deputed to a stratos of minor value. The duty of performing a certain labor or function lowers the armoostia of a stratos for other purposes and hence its capacity for doing other work.

The hostile attack will by preference be directed against stratoi having valuable functions to perform. They must therefore be so posted and so well protected, that the adversary must make great sacrifices to drive them away or to annihilate them.

Every manœuvre means exertion. In com-

pensation for it the manœuvre should bring an addition to the effects of the stratoi or at least an approach towards greater effect. The decrease of the effect of hostile stratoi is hereby counted as a positive result. In the eumachic manœuvre the proportion between the effort and the increase of potential effect is a minimum. The larger the potential effect the greater is the exertion which the opponent must make to avoid losses.

Whether one should regard this as a definition or an axiom depends mainly on the standpoint from which one regards these considerations. In any case, the last proposition does not admit of proof.

Whoever claims capacity, should attempt to produce a result. Neither originality nor the lack of it, not the ability to execute a task if one wanted to, nor the criticism of works of others, nor courage, self-confidence or a feeling of superiority count, but solely the final achievement.

Merely to destroy an existing condition or to deny an assertion that finds credence or to block an enterprise that is supported is doing work by half. Everything that exists has some claim for existence; a supporting *raison d'être*, without which the thing would die of its own accord. Let us for an example take the robber instinct as an extreme case. Bad as it is, in combination with the principle of justice it is an element of the force that helps to make the far sighted and venturesome but constructive merchant or the vigorous and sagacious statesman. And in a society that forgets its responsibility to care for all its members in a sense of charitable justice, the thief, in forcibly directing attention to the crying needs, acts as beneficial as pain to a sick body. A *macheide* searches for the good and before applying the force of destruction takes measures to preserve what might be of ser-

vice in future. In the business office, in the family, in social and public life, in fact in every machee a compensating productive activity must go hand in hand with aggressiveness and destruction.

It is not the character of a man that generates love or hate but the effect ascribed to him.

In society there are chiefly two methods of reward, that of capacity and of achievement. An achievement can be measured. To discover the capacity of a man is a difficult task. Where it is made the measure, the gate is thrown open to misinterpretation of motives and obscuration of achievements.

In a macheeide society, according to the principle of values, both methods of rewarding would lead to identical results.

A society which rewards its members according to their achievement, produces zeal for work where it is of most use and therefore approaches most rapidly the macheeide state.

Know thyself, or else thou wilt be unable to tell what kind of work thou canst perform and what rewards thou darest expect.

Examine all things, without any exception, as to their effect and the effort which they cost, and value them accordingly.

THE PRINCIPLE OF ECONOMY

According to its nature and definition the macheeide is infinitely economical with the machic energy at its disposal. Hence he who strives to approach the perfection of a macheeide must make it his maxim not to decide on a maneuver that brings an advantage, before having examined all other possible maneuvers, in order to ascertain, whether by postponing the above manoeuvre or by abandoning it and deciding upon another not a greater advantage might be derived. This proposition is so obviously true that it sounds commonplace. But, strange to say, the advice is seldom followed. Be it, that the prospect of gaining a success lessens the critical faculties, or be something else the cause, mediocrity invariably falls into the snare of snatching an immediate success, where it can be had at slight exertion, although frequently the result achieved falls infinitely below the possible. Blind eagerness to reap an advantage is the stamp that nature has put on mediocrity.

The seduction to act prematurely is never so great as when the opponent prepares an attack. One is then tempted to make a maneuver of defense. But the macheeide abstains from any such action unless it is forced by the enemy's maneuvers. For on the one side every parry consumes energy, on the other hand the opponent saves the energy that he would have to spend in order to force the safeguarding maneuver and he is therefore enabled to direct his attack against another weakness with telling force.

In every machée the first defensive manœuvre is the formation of a wall. As follows from the above consideration the machéeide will nowhere make the wall stronger than is necessary for its function, and will push it so far into the field that it is barely able to withstand the pressure of the enemy so that, by a small sacrifice, the enemy may force the wall back. But be it understood that the peril will be grave to advance beyond this point, for then the enemy will be able, by eumachic action, to obtain a success without loss. Usually it is not hard to determine the points where the walls of the opponents should meet. They will lie on the line of equal pressure.

To abstain from any defense as long as the threats of the opponent can be parried without preparation, is a task demanding courage and sharp intelligence. Before a decision is come to, the threatening danger has to be accurately analyzed and the question, whether the danger is real or apparent has to be examined.

In order that a defensive manœuvre should conform to the principle of economy, it must be executed with the least effort that is sufficient.

And even, if the machéeide cannot obviate losses, it attempts to satisfy the principle of economy in acting so that the surplus of its loss in energy over that of the opponent is a minimum. Oblivious of the approaching misfortune, it analyses the danger thoroughly and finds the manœuvre that is in accordance with the above rule. The machéeide is therefore not subject to panic fear. It is objective even under trying circumstances.

This then is the all important but much sinned against strategy of eumachic defense. Let the defender occupy the position of greatest armóostia, let him dispose his forces so, that in all directions, whence an attack is to be apprehended, his resist-

ance have the same strength, so that there be no weak points in his armor. But under fire he must cling to the position so chosen, immobile like an attacked porcupine, until forced to action. And he must under all circumstances faithfully follow the commands of the principle of economy. There is little of glory for the defender. The successful aggressor satisfies the craving that a multitude has for the spectacular and romantic—be the machee one of war, of art, or politics, of business or whatever kind—and is therefore rewarded by an abundance of honors. Yet deeds that in their nature are purely defensive, such as the faithful execution of a commission or a temporary stand against odds to cover a retreat, are often as effective, and may be as heroic, as a brilliant overthrow of a hostile position. The aggressor of genius puts a high value on those to whom he can depute a defensive task. He realizes that each detachment of force placed so as to be ready to parry potential blows that often are never struck draws upon his store of aggressive weapons. He knows that it is precisely his ability to ward off implied threats by a barely sufficient minimum of exertion which provides him with the means to follow aggressive tactics even under difficulties. This same faculty permits him to foresee the manoeuvres of the defender and to detect the weakness of the enemy that he may attack quickly and with momentum.

In view of the generality of machic conceptions we need not wonder, if these considerations have a larger application than at first appears. The maxims of the strategy of defense are not only valid in a contest between two or more parties, they retain their force when a man wrestles with a task and they are therefore of particular value for the artist and man of science.

In this connection the principles are of special

interest; for to the striving artist or thinker they are a compass which, in spite of the infinite variety of roads that he may wander, shows him the right way. The artist dominates the technical means of his art—words, color, sounds, matter to be moulded—and he wants to create a work that sets the sentiment of the beholder into a determined motion. The thinker sees a riddle and he wants to solve its mystery. The machic field is the sentimental or intellectual life of human society. The energy of the machee of both, the artist and the scientist, is the attention of society. They fail in their effort when their work does not arouse and sustain the interest of the beholder and student. They will always succeed in their endeavor, if their idea appeals, and if they express it in its entirety, with all that it implies, but with the least means. For, be it, that humanity instinctively loves truth before all, or that it hates superfluous effort more than anything else, an idea which is clearly expressed and economical in its execution has an irresistible power of impressing those to whom it is suggested. On the other hand, an exertion without sufficient motive is felt as an affectation, almost as an attempt to impose an untruth upon us, and we invariably call it ugly.

A writer will prefer short words to long ones, words that are deeply rooted in our intellect to those that have been learnt at a later period of our development, and variety to repetition. He will use associated ideas for transition from one paragraph to another, and he will avoid unnecessary precision that obliges the reader to think sharply. For in this way the reader needs the least effort for being attentive. An actor whose task it is to credibly represent a dramatic person by word and action should never make an effort by gesture or emphasis except where he thereby greatly facilitates the task

of the spectator of comprehending the person. If he overacts his part we are put out of humor.

Those who view with disfavor an attempt to subject the beautiful to an analytical research should read criticisms of acknowledged value dealing with works of art and artists. The critic demands the use of the simplest means and complete exhaustion of the motif, and he condemns everything that is unnecessarily fatiguing. He insists, for instance, on accuracy, sharp characterization and intelligible rendering. What he otherwise demands, refers to the technical skill of the artist or to the idea underlying the work, but not to the execution. We appear therefore entitled to draw the conclusion that the creative artist should strive for naught else than to produce effects by proportionate means, as the principle of economy requires.—The comprehension of work of economical execution is always accompanied by pleasure which is especially strong if the work is apparently not economical. The effect of witty remarks can be traced to this source. They are often apparently ubiquitous or contain apparent repetitions but they are in fact precise and to the point.

A work which has a manifest lack of economy and which thereby illustrates often committed errors is always humorous. The efforts of a clown or long sentences composed of well sounding words that have no meaning, or caricatures are instances.

Some years ago Wagner wrote the book on the simple life which created a great impression. As I view it, simplicity, in the sense as used by the French author, is synonymous with economy. A task is "simply" executed if it is done without giving attention to any other purpose. The simple man strives therefore to attain economy, because an

effort, which is unnecessary for the end, that he has set himself, will appear to him as entirely wasted. For the same reason we may always be sure that a complicated proceeding is due to a variety of aims. A complicated person has, unknowingly perhaps, another motive besides this one, which, as he wants us to believe, impels him. As a rule complication is caused by an often unconscious desire to draw attention to fine possessions, such as wealth or beauty or nice traits of character. But true beauty is simple, because it conforms to the principle of economy. And, as the old proverb *Simplex sigillum veri* tells us, also the laws of nature are simple.

BALANCE AND ADVANTAGE

In the development of a set of deliberations, whether they are called a science or not, there must come a moment when a desire for exact reasoning makes itself felt. The brain when meeting with a new line of thought is at first happy to romp about hither and thither among things intellectual, and quite ready to play with another in the same manner. But the moment that a line of investigation is consistently followed, and the intellect, taking a glance backwards, measures the large distance that has been covered, it suddenly loses its playfulness, becomes afraid and diffident and, for the purpose of making sure of not having been deceived, rigorously investigates, what it before had been easily persuaded to take for granted.

This trait is a healthy one. To suppress it, as many nations have done in matters pertaining to religion, social customs and traditions, arrests one of the sources from which progress and happiness spring. If it is given full sway, if the whole truth and nothing but the truth is admitted, the brain gains in power of conquest as well as strength of resistance against superstition and sophistry, because the critical faculty, like any other human faculty, develops when given exercise.

It would be an error to think that a scientist, as such, has no beliefs. The man who wanted to prove everything could establish nothing. Every system of assertions needs a set of axioms as a foundation, because all demonstration is at bottom only a logical reduction to a more readily granted truth. And it may be taken as a general maxim that the simpler and the more natural these axioms are, the fitter for their purpose they will be judged to be.

In our investigation we have now come to a point where certain abstract conceptions have to be defined and explained and studied. It is true that many experiences have made us familiar with these conceptions, but this is all the more reason why we should care to find out, whether we have known them really well, and whether we have estimated them at their true value. It is, therefore, only fair to those who want to be critical, as well as to ourselves, if we want to do away with our embarrassing and perhaps hidden uncertainties and doubts, to state a complete set of axioms upon which the theory, that will be developed, can rest.

Our first assumption is: When all parties to a *machee* are led by *macheeides*, no proposal of whatever kind can be welcome to all of them, though it may be indifferent to all of them. If men are the leaders of the various parties interested in the *machee*, there are reasons why the assumption should not be true. Men may be mistaken in their judgment of the consequences of *machic* manoeuvres, they may esteem an advantage what is the reverse. Besides, it is usually impossible to limit men's interests or even to enumerate all the parties in some way concerned in a *machee*. But *macheeides* have a perfect judgment; and their interests are entirely identical with that of the party they represent in the *machee*.

Our second axiom is that of continuity. According to a Latin proverb, Nature does not jump. A transition from one state to another is always continuous. We assume this to be true also in a *machee* and, therefore, lay down the principle: If in any continuous series of *machic* situations a certain proposal is welcome to a party when the situation is as on the one end of the series and unwelcome when the position of affairs is as on the other end, some intermediate situation must exist where

that proposal is indifferent to the party. Let us now consider the following situation:

An arsenal is filled with weapons, men, horses, etc., in short with stratoi of various kinds. Its commander orders a macheeide whose name is M, to collect from it a force of sufficient strength to keep in check an enemy E, who is suspected of hostile designs. At the same time he requests M to be as sparing in its demands of stratoi as is possible.

E is commanded by a macheeide, to which it is entirely indifferent how many stratoi are annihilated, as long as it can attain certain aims, that it hopes to further by war.

The question is, what will M do under these circumstances?

We assume that if it demanded all the stratoi of the arsenal it could defeat E. Otherwise the question would have no meaning, as M could in no way make it profitable to E to abstain from war. We also suppose that, if M had no force at all to oppose E, E would attain its aims.

As to the forces in the arsenal, let us imagine, that they are of such varying degrees of strength and can be so finely subdivided that M may take from it any desired quantity of jonts of various kinds. In real life this might, of course, not be so. A soldier, for instance, could not be subdivided, yet we are entitled to the supposition that we have made because its unreality does not invalidate the logical reasoning applied to an imaginary case.

Now let us construct any arbitrary continuous series of jonts from nothing to the full limit of the arsenal. A proposal to E to begin war against an army composed by a certain element of that series of jonts, will be welcome when that element is on the one end, unwelcome when it is on the other end of the series. Hence, somewhere in the middle of

the series, according to our second axiom, there must be an element which, placed under M, would make the war a matter of indifference to E.

That element, it will be said, holds the balance to E.

If M and E went to war in the state of machic balance, neither M nor E could further their aims in any way, or else the war would be welcome to one, unwelcome to the other, and could not be indifferent to either of them. Hence we can say: In a balanced machee between two macheeides neither side can make progress towards its aims.

Or else:

In a balanced position the struggle of a macheeide against a general who occasionally commits mistakes, cannot be in favor of the general, no matter, how ingenious his manoeuvres might be.

Or else:

In a balanced position there is a sufficient defense against every attack.

Let us now return to the struggle between M and its enemy. Having by some means discovered the requisite number of jonts that will ensure a balanced machee, M will collect its army from the arsenal and will then place it into a favorable position. For this purpose an imperfect mind would have to investigate a large number of attacks that E might undertake with the object of gaining advantages; it would to that end have to analyze the process, by which E would gain one of the advantages in question, find out many ways, how to stop the advancing stratoi of E, and then arrange its troops in such a manner, as would permit them to easily parry many of the anticipated blows. A macheeide might follow the same method, but more thoroughly and exhaustively, and it would therefore finally dispose its stratoi in a position of large, if not of maximum armoostia.

If in a machee between two macheeides the proposal is made to them to transpose the position into another which is balanced, according to the first axiom one of them would accept, the other one refuse, unless the proposition is indifferent to both of them. In the latter case, the original position can only be a balanced one, for if there were any attack in that position that had no sufficient defense, there would be a reason why one side would reject the proposal. In the first case, the side that would refuse the proposal is said to have the "advantage," its antagonist the "disadvantage." In a balanced position neither side has the advantage.

The party which has the advantage can make an attack which admits of no sufficient defense. For otherwise the position would be balanced, and the macheeide would have had no sufficient reason to refuse the proposal above stated.

We have here introduced the words attack and defense without a definition. An attack is a process, in the course of which usually big effects are achieved by the stratoi of both parties, and in which one side aims at a certain purpose while the other side attempts to defeat it. The purpose may be nothing more than to exclude the opponent from a portion of the field; it may be as great as the annihilation of an army; it may, in short, have varying degrees of value. In any case it is such that its achievement would further the aim of one of the combatants.

The defense either prevents the aggressor from gaining his end or else puts him before the alternative of paying a high price for the execution of his desire or of abandoning it. All this can readily be shown from the propositions stated above, which would be manifestly untrue if attack and defense signified anything wider or lesser.

There are varying degrees of advantages. For

let A and D denote two macheeide antagonists, of which A has the advantage; and let the proposal be made to them to agree to a slight change in the position. Either A consents, then the change would be advantageous to it and a detriment to D. Or A refuses, then the converse would take place. Or, the macheeide might be indifferent, then the situation would not be affected as far as an approach towards the aim of the machee is concerned. Hence it follows:

The greater the advantage of a party, the more profitable is the attack that it can successfully carry through.

The principle of work gives us means at hand to classify advantages. The machic work done being the measure of the approach towards the aim, it follows, that the side holding the advantage can do more work than the other. This can result from two causes, from the greater number or the greater turnout of the workers. Hence we may speak of numerical or positional advantages. And, since also the undoing of hostile work counts in the sum total of work done, and the field may be used as "cover" against effects of the enemy, the positional advantage may again be subdivided as due to the field or to the better arrangement of the forces.

Let us suppose that the two hostile armies are very far apart, so that their pressure upon each other is a negligible quantity. Then the question, which of the two sides has the advantage, can be definitely settled. Remembering that under these circumstances a macheeide will obtain more work from the group of stratoi of greater value, we may say: In a machee of two opponents that are far apart, the army of greater value has the advantage.

Consequently the weaker army must seek for counterbalancing advantages, such as would ac-

crue from the nature of the field or positional arrangement. But if it would fight where the field did not favor it, it could obtain positional advantage only on account of a mistake by its opponent, because the latter possesses the advantage and cannot be deprived of it as long as his manoeuvres are eumachic. It follows then: The weaker side can be forced to fly or to seek refuge in the parts of the field favoring it.

All these propositions are true only in contests between macheeides. Nevertheless, even for the struggles between erring mortals they are of immense usefulness.

The man who, in an important machee has to decide on the strategy to be followed, relies on his mental work. By inspection and by every other available means he gathers information on the position of affairs and thus sets his imagination at work to discover, what he has to fear and to determine his line of attack. Very often he gets wearied trying to construe an attack, only to find, that in each one of his attempts, may they be ever so ingenious, there is a slight flaw somewhere. Again often he sees a danger approaching, and cannot foresee its result. Even if he remains cool and takes the best means for the defense, the uncertainty of the outcome wears him down.

Now consider the position of this man when he is told, that his side has a slight advantage. His uncertainty and weariness are brushed away. For if an attack is directed against his side, he knows beforehand, that, however dangerous it may appear to be, in reality there must somewhere be a resource ready at hand, which will turn the attack and that possibly he may inflict decisive defeat on the enemy. Again, if he assumes the aggressive, he knows, that he has the right to expect some small gain, because of his slight advantage.

Or let him know that he has a slight disadvantage, he will then at the outset realize that he must avoid aggressive action and look for safety in a firm position. He will not push his "wall" quite so far as the antagonist. Should the enemy press him hotly, he has the comfort to know, that with best defense his loss can at the worst not be very severe, as it must be in proportion to his disadvantage that is only slight. The attack of the opponent even gives him the hope to retrieve his fortunes, for in the violent actions of a lively aggressive movement large effects may be rapidly achieved.

In either case, before he begins his search to find the right strategic maneuver, he is assured that the heart-rending experience of wearily and patiently seeking a phantom will not be his.

The methods of driving an advantage home, diversified as they are, have a few common traits of which, in what follows, a sketch is drawn, that, however, makes no claim on accuracy or penetrating analysis. If the armoostia of the opponent is small and if one is not pressed for time, it is advisable simply to cut off the retreat of the enemy. This cannot be a difficult task. The foe is then obliged to make a desperate attack or to surrender. But if the gain of time is important, it is necessary to conduct an attack without much preparation. The onslaught must of course be directed against the greatest weaknesses, as shown in the chapter Strategy. The attack must strike quick blows, every maneuver must be calculated to increase the immediate effects of the stratoi, until one vital spot of the enemy after another is vulnerated.

To carry through such an attack, a very large preponderance of force in the decisive points is, however, necessary. Otherwise, against a cool-headed and enduring enemy, the attack may end in disastrous retreat.

Although we use the terms of warfare, we may apply these considerations to pacific pursuits, such as, for instance, the invention of a patent. The enemy is in this case the inherent difficulty of the task, and the stratoi are our braincells. When the inventor has brushed some of the obstacles away, the armoostia of the enemy has decreased to that extent. Patient investigation of the problem from all its various aspects is the right strategy, unless one is pressed for time. In that case a battle of the brave braincells against the stubborn enemy will ensue, in which many heroic deeds, if the task be difficult, have to be performed before the victory is achieved.

If the armoostia of the foe is large, it is necessary, before a forceful attack can be aimed at him, to lower his armoostia. Whether this is possible depends altogether on the situation and mobility of his weaknesses. Even if only one of his weaknesses can be attacked, there is almost the certainty of a great victory. The attacked weakness requires a defense, the defensive force may be attacked, another parry is forced and so, little by little, the armoostia of the enemy is exhausted by threats. If, after continuation of this process one has still unemployed force, whereas all the power of the enemy has been drawn into action, a decisive victory may be attained, by assailing with the reserve force a vital point.

A philosophical dispute or a legal contest is an example for such a machee. The party that holds the advantage forces the opponent to submit to the decision of questions, so as to impede both parties equally in their choice of arguments. At the end some argument decides, that, by dint of the preceding decisions, has become unanswerable.

The process described above is greatly facilitated, if two equal forces of the opponents enter into a contest or "bind" each other. And it is

quickened, if they annihilate each other, unless the enemy rids himself thereby cheaply of a stratos of small armoostia that might draw him into a big action. The weaker side must therefore avoid to bind its forces and rather resign weaknesses of small armoosita to their fate than risk a decisive engagement, unless in a very favorable position.

In fencing, boxing, jiu-jitsu and other physical struggles the forces of the two combatants "bind" each other when fatigue is produced. It is therefore advantageous for the stronger party to fatigue the opponent, even though he wears himself out in an equal ratio. He can accomplish this by force, in making threatening motions that require for their defense as much exertion as the assailant gives out for their execution. And if the weaker side makes an attack, it should be the policy of the party which holds the advantage in strength not to merely evade but rather take the blow, in whole or in part, and give one of equal vehemence in return. In fencing, however, such tactics are very difficult of execution, because of the usually dangerous nature of the wounds produced.

The problem is greatly complicated if great strength is opposed by great armoostia. It would then even be difficult to determine which side has the advantage. In spite of the disparity in strength the struggle may be balanced, as the boxing encounter between Sullivan and Kilrain exemplifies. Everything then depends on the "wall" that the stronger party can erect and the "pressure" it exerts, or, in ordinary language, on the enclosure within which the struggle takes place, and the domain within which the opponents can deliver blows effectively. If the stronger man by a slight movement can force the opponent to a quick movement, he gains to that extent, and he should finally wear down his antagonist. And if

the physically weaker man can deliver effective blows rapidly enough to escape a reply, the advantage lies with him. Whoever has the advantage, a violent attack of the inferior side, if correctly parried, can only turn out to his loss, because, as we know, the machic superiority (or advantage) can in no way be shattered, if held by a macheeide.

When the process of weakening the eye, the feet, the critical reflection, etc., has been going on for some time, the opportunities for vehement attack increase rapidly. When in fencing, for instance, the opponents can no more as surely see or as strongly and quickly move the wrist as at the commencement of the duel, the reserve, which had to be practised at the beginning, ceases to be necessary, and for the stronger party it would even be a mistake to continue that policy. He should then expose himself to some extent, provided only, that by the attitude which he assumes, the number or the momentum of his threats also increase. The greater the fatigue of the two sides, the more profitable becomes the policy of aggression. The attack has of course to be aimed at the greatest weaknesses of the antagonist, as the principles of strategy, previously discussed, illustrate. If, for example, a fencer has succeeded, by a frequent repetition of the same rhythm of strokes in fatiguing the attention of his opponent, he should assail the corresponding weakness by rapidly making a thrust which utterly breaks the rhythm and requires quick conception for its successful parry.

Let us now consider a machee in which men are daily engaged but which they seldom conceive as a struggle, the understanding of a truth or the critical acceptance of an impression. To begin with let us study the field.

The brain is an organized army of cells or, let us say, of elemental organs of life. By impinge-

ment with waves of matter producing sound, light, smell or taste, an organism that by heredity and adaptation has become particularly sensitive to such impressions, communicates through an electrolytic process the disturbance to the brain. To speak in general and less definite terms, a movement coming from outside, travelling along nerve wires, produces a state of commotion in the brain cells. As movements in Nature never have an end, the vibration in the brain, which we may term an idea, slowly passes out of it, until it sets the muscles in motion to transform itself into laughter, weeping, gestures and other movements. In this process the original idea, in continually weakening and spreading, produces motions corresponding to sets of other ideas but with diminished intensity. These are the ideas associated with the original impulse, which, as the idea is given time to work its way, insensibly fade below the level of consciousness. They are productive of the state of low consciousness that we call dreaming.

Within each cell the idea creates a chemical process, which consumes some substance that has to be replaced by the blood. In acting thus, the idea overcomes a resistance, because no movement can initiate another without being weakened thereby. According to a general biological law, any change in the composition of a live organism produces fatigue; and pain, if the fatigue is great. The pain of the braincells shows itself in lack of attention and loss of interest and, if aggravated, in disgust. We have no reason to doubt that each idea produces a slight degree of pain, because Nature never jumps from one state to another but connects them by states of continuous transition. The cells offering a large resistance to the idea are materially affected by it and so altered that they lose their identity. This fact is comparable to

others that we know of elastic bodies. They will oscillate into their original position, if subjected to a small strain, but they will break or at least become loosened, if the energy of the strain is beyond a certain limit of intensity. Hence, the idea, in reforming some cells of large resistance, weakens the total resistance. And if we are again subjected to the commotion causing the idea, we offer less resistance to it. Thus an idea, often repeated, paves itself a road of least resistance and its force gains in degree.

Let now several commotions follow each other in so rapid succession that they have not sufficient time to set up the state peculiar to each of them. Then a complicated commotion will ensue which is painful unless the ideas bear a relation towards each other which we might call harmonious. A piece of music may serve as an example. Each individual note is an impulse to which a certain vibratory state in the musical centre of the brain corresponds. If, before this vibration has ceased, another is superimposed, the dreamy, half-conscious commotion due to the first note is still in existence while the full force of the second tonal attack is developed. The dying motion due to the first tone may support the energy of the second tone, then we have harmony. If they antagonize each other, we have discord. The same is true of color. To each color there corresponds another with which it is most in harmony, and this correspondence is the same for all human beings. Red and green are, for instance, so related. Nor is there any reason to doubt, that we may speak also of harmonious smells or tastes or even of harmonious thoughts.

All this is equally true of a sequence of brain motions. Their harmony is greater if the fatigue that they produce is less. Harmony, in the wide

sense, as here understood, is therefore aided by the judicious selection of rhythm and by such variety as would cause a multitude of cells to oscillate and the strain upon the individual cells to be slight.

Intense harmonies produce a rapture, in which the interest is chained to one subject and which sets us dreaming. Then we are in the land, which we never leave without regret but, alas, dare never visit without paying the toll that fatigue finally demands.

Harmony as here defined is a conception applicable to every art and to every science and to every series of actions intended to be viewed and mentally understood by others. Men possess a critical sense of harmony in varying degrees. The heaven-born artist has it highly developed. A creative genius has it, wherefore he is often equally perfect in various directions.

In common with any other trait of live organisms, it is developed by judicious exercise and dwarfed by neglect. The exercise determines the direction of its growth. If Raphael had, by some chance, in his youth acquired a taste for mathematics, he would, by reason of his sense of harmony, have become a great discoverer. And if Newton, in his period of development, had been inspired with as intense interest for the drama as he had for intellectual research, another Shakespeare would have arisen.

Very different from the receptive process, that has been described above, is the creative activity which may broadly be called "reflection." If a man ponders, he wants to solve a riddle that interests him. This desire prompts him to disconnect his brain from outward impressions and to search. As an insect puts forth its feelers to obtain an impression of such properties of the environment as interest it, a mechanism in the brain sends out

thought impulses in order to study the corresponding motion. And as the insect stops in its search when it believes it has achieved its purpose, so a critical faculty puts on its brake, when imagination has been sufficiently active. This instinctive criticism not only performs the important function of stopping the outflow of energy due to the working of imagination but it directs the outflow while in progress. It is therefore of as great value for achievement as imagination. The mechanism of reflection is not in order unless the critical and imaginative faculty are adjusted to each other.

The critical capacity is, as all instincts, a sub-conscious memory of past failures and successes, to which heredity has contributed the greater and individual effort the smaller share.

The field and some of the stratoi having been described let us now investigate one of the many machees that may here take place. A man, distinguished by no especial gifts, in his character as a unit of society may serve as prototype. Every one of his actions impresses others as well as himself. An act of his cannot but start an "idea" in those with whom he comes into contact or at least in himself. His traits of selfish enjoyment or altruistic sacrifice, of subjective reasoning or justice, of sympathy and appreciation for others or quickness to condemn and hate, of willingness to work or of readiness to use the efforts of others determine his doings and these react conversely in moulding his character. What he sees others do has an equal influence upon him. If his sense of justice does not rebel against ruling customs which are unjust, it withers. If he does not exercise it, it is dwarfed. There is an irresistible unconscious reciprocity about men and things. If a man tries to make others glad, they will unknowingly try to make him glad. No lie will pass long under the

continual scrutiny that is silently exerted. A man who has no regard for truth will lie even if he is dumb. The lie of vanity, of fear, the malicious lie, will translate themselves into action, and the observer may detect them by some uneconomic exertion, that shows the imagination of the liar at work when the truthful man would enjoy rest.

His desire for truth and his sense of justice, his capacity for sympathy and for work are therefore the essential elements of a man's character. They are instincts capable of development as of degeneration. It is within the range of a man's ability to strengthen these traits by adherence to strategic principles. According to Darwin's law, and in uniformity with our previous explanation, each economic effort in the right direction makes the next effort easier. If the effort is not economic, there is waste of vital energy and loss in efficiency, because the critical instinct is misguided at least to the extent of that one experience. Thus the principles of work and of economy are here of great importance.

Also the laws regarding machic advantage have here a meaning. To see this clearly, it is necessary that we should locate and identify the enemy. The foe is a desire to enjoy without equivalent effort, and it is represented in a thousand different forms. It is reinforced by tasks set us, of caring for our body and of conforming to our responsibilities to others. Vanity as such is by no means inimical. The machic aim is to be happy, and that is impossible unless we are happy with others, but it is equally impossible without the propelling power of self love or ambition. Only in so far as vanity makes us unjust or subjective and thereby becomes antagonistic to the purpose in view, have we to classify it as a hostile stratos.

We make an "attack" in this machee when we

strive for happiness. In our present day society, I fear that we lay too little stress on the glad feelings. Joy is Nature's reward for acting right and much better than any substitute that man has invented to take its place.

The outlines of the battle are now drawn. There are easy roads to purchase happiness by a small effort, but only for a little time. Alcohol, cocaine, or other nerve irritators, form a hostile battalion. Untruth or unfair dealing, intended to obtain unmerited advantages, another. And we need only go through "Pilgrims' Progress" to sketch the whole battle array in detailed formation. If we do not defend ourselves against them, we are the losers. because a depression compensates Nature, which we may try to but cannot cheat. And, what is worse, our finely organized system of braincells deteriorates in consequence. If, on the other hand, we do not enjoy ourselves when we are entitled to it, we also make a mistake in the machee. And, without analyzing the question further, we know from our previous strategic laws in respect to advantages, that each omission to profit by an opportunity is bound to benefit the enemy in some way. It is, consequently, essential to know, where we have the advantage and may attack, and where we must defend ourselves and when to develop our forces.

And, generally, we must come to the conclusion, that in this machee all strategic laws that have been established as well as those that may in the future be discovered, must find expression and application.

CHANCE

An objection may be raised against the conclusions drawn. How do we account for the rulings of chance that often determine a struggle? Will you answer us with the platitude that there is, fundamentally, no accident? Will you not admit that hazard must be a powerful factor in life, as long as we do not know the effects of all causes? Or are you arrogant enough to attempt to write for supermen?—

These questions might legitimately be asked and may have been in the minds of readers of this book. Perhaps I should have declared at the outset, what place can be assigned to this inconvenient conception of luck and chance. It is true, even a maceeide, notwithstanding its infinite skill and genius, may become a victim to an unforeseen accident. There are conditions where hazard rules so supreme, that such wisdom as can be obtained by men, however perfect, cannot predict the events. But in spite of all this, the deliberations of the preceding chapters need only to be slightly modified to meet all objections, provided that we grant the law of probability. And experience has shown that this law can claim a high degree of accuracy at least.

If on a round board with a number of holes a spherical ball is placed, if the board and ball are set in motion independently of each other and if the ball cannot rest on the board on account of its curvature, the ball will clearly have to come to rest in one of the holes. Should we ask a physicist into which hole the ball will finally drop, he would reply with a number of queries. What is the

shape of the board? What is its substance? Of what matter does the ball consist? How many holes and how big are they? How are they placed and shaped? What was the position and the motion of the board and of the ball at the beginning? What was the temperature of the room? How did its air circulate? After we have made the necessary measurements and replied to his questions, the man of science will be able to determine, by a complicated calculation, the course that the ball must take under the given conditions and where it finally must come to rest. But even then, he will have been obliged to treat some of the causes and circumstances determining the event as negligible and his result will therefore only be a near approximation. The result achieved in such a way depends on so many varying circumstances and costs an effort so disproportionate to its value that mankind takes the liberty, in such and related cases, to treat all the causes as negligible. And it prefers to determine by experiment, how often in a large number, for instance ten thousand trials, the ball will drop into each one of the holes, and is satisfied with the assumption that in a million trials the ball will drop about a hundred times oftener into each of the holes than in ten thousand trials, although this will not express the truth exactly.

Whenever a multitude of causes determines an effect and the effect is greatly different when one of the causes is slightly varied we are in the same predicament. And we use the expedient of assigning a probability to an event whose causes we cannot or care not to investigate.

The "probability" that an event happens under stated conditions is a fraction of the unit, that is intended to tell us the ratio of its happenings to its trials under above conditions. Thus we say that the probability that a die when thrown will show

a two is $1/6$ implying, that, if we throw it sixty times, it would probably show a two ten times, and if we throw it six thousand times it will probably show a two a thousand times, etc. As frequently important events depend on chance, many are confused by the apparent injustice with which hazard deals out its rewards, and they imagine that a mystic power determines its decisions. But they forget that he who is ignorant of the working of causes and yet dares to trust his fate to an effect determined by them, has made no effort to merit preference before others similarly placed. Hence he has no claim except in conjunction with those who run the same hazard. And if the fate of these, collectively, is considered, it will be found to be subject to the rulings of an impartial justice.

To illustrate this point, let us imagine, that the realization of an event yields us a benefit and its failure to realize inflicts a loss on us. We should consider the situation a disadvantage if the ratio of loss to benefit is in excess of the ratio of the probability of the occurrence of the event to the probability of its non-occurrence. And under reverse conditions the situation is advantageous, while in case of equality of the ratios the position is neither worth a sacrifice nor to be avoided. To fix the ideas, let us assume that the probability of the event is $1/10$, hence the probability of its non-occurrence $9/10$, the value of the benefit 8, of the loss 1.

If a man, contrary to our advice, would subject himself to the working of the hazard, he might of course be successful. But all men who would thus act, considered in their aggregate, would sustain losses. For if the above probabilities are correctly measured, of one hundred thousand such men ten thousand would be gainers to the extent of eighty thousand units of value and the other ninety thousand, each losing a unit, would more than

counterbalance the gain. In time these men, though some of them may prosper, will as a class have forfeited values that they could have retained if they had acted according to the above stated principle. And again, let, under similar conditions, the benefit be worth nine units, the loss being one. The category of men who would make an exertion to avoid the risk would, after a time, not be in a better position than those who treated the question with indifference. Their exertion was therefore a complete waste. And finally, if under the same conditions the benefit had been ten units, those, who would avoid the risk would, as a class relatively to those who dared be losers.

These considerations must not only be applied to money, they refer to the most varied kinds of values. The pioneer in each branch of activity runs a great hazard. He attacks the unknown and he exposes himself thereby to losses in terms of vitality and happiness, to be rewarded, if he succeeds, by the satisfaction of having conquered an obstacle to a social good, by the esteem of his compatriots sometimes, by the love of woman oftener and by a little of the things that Solomon called vain. A nation possessing many who dare a venture that is productive in our sense, will grow; another whose ablest pioneers, from lack of opportunity, assail unproductive issues, will deteriorate. And a nation that, for any reason, has lost its spirit of enterprise, must in a world full of opportunities be finally outdistanced.

There is a feeling, in some countries, against running risks that can be avoided. To stake values on a hazard is there called immoral. But if these values are of intrinsically little importance, what does it matter if they are lost or transferred to other hands?—If they are of high worth, is not the gain also of the same quality? It is, of course, im-

moral knowingly to induce others to run unprofitable risks—and this immorality is rampant—but it is only imprudent to run them oneself.

Let us now suppose, that in a machee the working of causes is so hidden that even a macheeide cannot discover it. How will its strategic maneuvers be influenced? And how must our preceding considerations be amended to meet the altered conditions?

The macheeide will investigate all circumstances that may be of value to it. This is merely an application of the principle of work. Where it cannot discern the causes of an effect, it will at least study the surrounding conditions and attempt to form a judgment by inference. But where it can, in no way, obtain information as to the outcome of an enterprise, it will be guided by the law of probability, as we must conclude from what has been stated above. It will therefore treat the probable benefit accruing from an exertion or maneuver as if it were the real benefit, and it will consider the probable value of the exertion in the same light as if it were the real exertion. Thus the propositions in respect to strategy, the principle of work and the principle of economy will remain valid if only the word "probable" is inserted before the words work, value, economy, pressure, weakness, wall, etc., as they occur. And, with this proviso, the statements in the chapter on balance and advantage will remain valid, because our previous reasoning will lose nothing in its force when this change is made. And indeed, we may even go further and assert, that no future discovery relating to machees, whose events are due to causes that can be thoroughly investigated, can lose its value for machees where chance holds sway, provided only, that no new axioms are added to our own. If we admit, as we must, the law of probability, any logical con-

clusion valid in terms of work, exertion, etc., must remain true if applied to machees of chance, provided only, that instead of work we speak of probable work, for exertion we substitute probable exertion, etc.

Wild beasts have a well developed sense for probabilities. They have their lair in the least accessible and least conspicuous places, and such as we would call in our terminology, the points of the least probable pressure. In flight, they have a wonderful ability to quickly discern the line of least pressure. It would be interesting to chase an animal by two dogs of about equal velocity and placed at the same distance from it. Will the animal take the direction that halves the angle which it forms with the dogs? Very likely it would on a level plane. And when stones, woods, hills, knolls etc. are about, the animal would probably select the line of the least probable pressure, no matter how complicated the situation may be. Animals are quick to draw inferences. A wolf follows a trail made by a likely prey. If, warned by its excellent sense of smell, it thinks itself pursued, it runs to a knoll, not in a straight line but in a half circle, to bury itself there so that only the eyes show, and to watch whether its trail is followed. When it has made certain of that, it runs rapidly away. In the hunt for big game, it calls in a typical manner for aid from its comrades. In the search for prey the company disperses.

Some insects have the wisdom or the instinct to seduce their foes to draw false inferences. When they fear attack they feign death. When the assailant is not deceived thereby, they rapidly fly. Many species of insects have two varieties, of which the birds find one suited to their taste, the other not. It oftens occurs that a tasty insect assumes the garb of the other variety. We may look upon all these,

and related matters, as the natural result of the survival of the fittest principle. But it remains, nevertheless, a curious fact, how much of strategic acumen is displayed by animals and how accurate is their judgment of the probabilities that mostly concern them.

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We know that in a balanced machee between two parties, every possible attack has a sufficient defense. If hazard enters into the conditions of the machee, the probable gain accruing from an attack that is rightly met, will at most equal its probable loss. And if a macheeide has the advantage, the probable gains of its opponent will be inferior to its probable losses. Hence, if the machee between the two is often repeated, the macheeide will finally be the gainer.

The roulette table and card games are simple instances of this kind. The advantage at roulette is with the bank. In consequence it wins, if a large number of bets are made, whatever manœuvres the players might execute. Many believe that by following a suitable method, they can defeat the bank, and they attribute its success merely to the lack of system and to the large number of players. But this view is a decided error. The favorite method of increasing the stakes after a loss makes it very probable that the player will carry away a gain. But values so won are small, and they are more than counterbalanced by the loss of all the bets which must occur sometimes, because all accidents, or chains of accidents, however unlikely they may be, if they can happen at all, must happen occasionally. The player who increases his stakes after losses is very much like a man who offers the odds of 200 to 1 when he should lay only 150 to 1. He will win often but be a loser in the aggregate. The reverse system of increasing the amount of the bet in luck

"with the money of the bank," as the players express it, is equally faulty, because the higher the gain is at which the player aims the oftener he will lose small amounts, and the gain if finally secured, will not equal the sum of the losses. But it is entirely indifferent how one bets. One probably loses a certain percentage—at Monte Carlo $1\frac{1}{2}$ —of the sum total of the risks run, in whatever parts and proportions and intervals from each other one may make them.

In card games, such as Whist, Bridge and Skat, the guiding rule for the player is to objectively examine the situation and to always proceed so as to make the probable gain a maximum, or, if a reverse cannot be avoided, the probable loss a minimum. There is no difficulty in calculating the probabilities of events occurring in card play except in so far as inferences may be drawn from the play and the personal element may enter thereby. But in that case the question of finding the value for the probability of a surmised situation is only complicated and is by no means away from the grasp of the analytic mind, because inferences are after all only information plus a probability value. In all cases the probable gain of any manœuvre M can be found, by noting all possible distributions—if inferences can be used as guide, some of these distributions will be less probable than others, else they all will be equally probable—determining the gain of M in each one of these distributions, and finding the average of all these gains.

And inferences add to the complication by ascribing a larger or a lesser factor to each distribution according to its inferred probability. The player has to calculate the probable gains or losses of all possible manœuvres and finally to select the one that yields the largest probable profit. In practice, this calculation is often very easy. The skilled

player has committed the probabilities of distribution to memory and is guided by an unconscious process of quick mathematical reasoning that experience has developed. Skat, Whist and Bridge are balanced machees. In a company of fine players, if they engage each other frequently at these games, the gains and losses are insignificant.

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And here it is perhaps in place to call attention to a human weakness to which a great deal of suffering is due and which strongly accentuates the advantages to be derived from the study of strategy.

All the hundreds of thousands who in profitless wagers jeopardise their dignity as men and waste their happiness, are victims of a false conception. One might believe that they are impelled merely by a too fervent spirit of daring. It is not so. It is the belief in a "system" which they have found, that lures them on. I have argued with many hundreds of men who were convinced of the excellence of some particular method of wagering on cards or roulette, or horse races, or the rise and fall of shares etc.

But although their error, critically examined, was manifest, I have not in a single instance succeeded in shaking their conviction. Their system was to them an adored fetish and they regarded with little kindness one who criticised it.

In his heart every infatuated gambler adores such an idol even though, like a heathen, he may occasionally change his gods. When his fetish is deposed, the player is freed from his passion until he has made himself a new god. Then the hope of easily and rapidly acquiring wealth takes hold of him again.

Is such "system" anything but a falsely conceived

strategy? Is it probable that he who has grasped strategic principles would adopt such a belief?

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Chance is of great moment in business. The Government allows to the Insurance Companies a "probable gain" which shall defray their business expenses, pay the risk of the founders and yield to the clients a share of the profits. The probable gain is so nearly certain that such enterprises, in spite of untoward accidents, fail very rarely. And the capital invested in this line of business is of an enormous magnitude.

A business man is frequently given the opportunity to participate in a commercial venture whose fate cannot be predicted with any certainty.

Our principles tell him his best policy. If totally unknown factors determine the enterprise, he should exhaust every effort in investigating them. To act differently would be very foolish, because the knowledge thus obtained often permits vigorous action to great advantage, for instance, on the exchange, and in any case is an excellent line of defense against attempted fraud. He should then calculate the probable gain of the enterprise and compare it with any other use that he might make of the labor, capital and credit at his disposal. After this he should be solely guided by the magnitude of that probable gain, no matter where his inclinations may tend or what advice undefined fear might give him.

Coincidences and events of slight probability astonish and impress us, because we are prone to forget that probability is the percentage of realization to trial. And if a slight noise, such as the rustling of leaves, the screeching of an owl, or a slight change in illumination, a passing shadow for instance, accompanies the improbable event, a mystic curiosity is aroused, we are fearful and intensely sensitive in such moments, especially when alone or in the twilight. This

peculiar sensation which is both poetical and religious, a shudder and a delight, particularly in women, is a relic left us, a once powerful instinct now dwarfed by neglect. There was a time in the evolution of man, where warfare and hunting were his constant occupation, where he himself was often hunted, and where woodcraft was of the greatest value in the struggle for life. The approach of the enemy was silent and unseen. Only slight noises, the cracking of a branch, the cry of a frightened bird, and perhaps passing shadows would herald his coming. Hence the ear was then trained to catch those noises, the eye those shadows, and an instinct joined their nerve centres to the sense of self-preservation. In his quest for a woman, man would often follow the same tactics of aggression as in hunting. He would avoid giving a hint by events improbable in the environments, wait with bated breath after an untoward accident, such as the breaking of a dry twig, and finally when he had stolen near enough, run to attack.

The environment having changed, that instinct has become useless for the struggle of existence and is rapidly decaying.

But an organ or instinct that has once been powerful, though suffering from neglect, will always leave a trace of its existence behind.

That is why the occurrence of a very improbable event attracts our attention, and suggests itself to us as a revelation of a mysterious force of great strength.

THE PRINCIPLE OF LOGIC AND JUSTICE

Let us imagine an extended field of varied shape on which two armies are in battle. Let us picture a column firing, then advancing at a rapid pace then stopping to kneel down and fire again. Then, a hand-to-hand encounter with the bayonet, a cavalry in rapid ride impatient to use lance and sabre, men crouching behind earthworks and firing with caution, balls bursting and bullets flying wherever the eye can see. Let us fancy the general in consultation with his staff following the events with intense interest, studying their purport and sending out orders. This picture may serve us as the model or the allegory for a machede.

We set the problem, to analyze the situation and to read the thought in the general's brain.

The two parties will make exertions continually. Let us consider the happenings of the machede within a very small interval of time, of, say the millionth part of a second duration. Then a few bullets will fly through a little space, a few muscles will make a trifling movement, a man will sink, a shot will be prepared, the brain of the general will begin to form a strategic thought, ammunition carriages will roll a little distance, etc., etc. The changes in the situation will be exceedingly small.

The totality of all simultaneous small movements of a party may be called a "small manœuvre." At every moment both parties execute therefore a small manœuvre which minutely and exactly describes the change taking place at that moment.

The effects of the machede have a definite direction. The fire of each gun and each battery is directed to where the aims are near and dense. If the struggle

is eumachic, all forces are engaged in the direction where they may achieve the best results, and if the contest is nearly eumachic, this condition will approximately exist.

In consequence the fight may be divided into a series of minor fights. Here contends man against man, there a number against a number, battery against horse or battery against battery, etc.

Every instant each unit of the force has a circumscribed region of action where it can use its power to advantage.

Let us now divide the combat into all its partial combats. Their number may of course greatly vary. For brevity and precision we shall put it equal to 100. A hundred groups of one party, denoted by A_1, A_2, \dots, A_{100} contend against a hundred groups of the other party, denoted by B_1, B_2, \dots, B_{100} . A_1 aims its effects at B_1 , A_2 at B_2 , etc. A_1 does not direct its effects against B_2 , because B_1 , at the time and in the position under consideration, gives A_1 a better opportunity for effective use of its weapons than B_2 .

The battle is therefore divided into partial contests according to the principle of the maximum of machic work.

Those battalions whose work is small and which exert themselves slightly belong to the group of reserves. They, too, have each moment a circumscribed sphere of action whether they are marching to take up a flanking position or posted so as to defend the flanks against hostile attack; or serve to take the place of some exhausted battalions. The best opportunity open to them acts on them as a magnet acts upon iron. But it may be said that they can respond to sudden calls on their power better than the forces more actively engaged.

The battle, after being decomposed into the hundred battles, A_1 versus B_1 , A_2 versus B_2 , etc., can

be followed with comparative ease and understanding. There are several reasons for it. The arrangement cannot change often. When it does change, there is some distinct motive or reason or incident that produces the change, and this impresses itself on the mind of the general as a machic force of importance that he must try to use to best advantage or to paralyze. And last, but not least, in the partial fights, A_1 versus B_1 , etc., smaller numbers are engaged, a smaller space is occupied, all circumstances are simpler than in the battle as a whole. It may be assumed that the general has a thorough knowledge of how the hundred minor fights should develop, because our understanding always progresses from the simple to the complex. The matters pertaining to the fight A_1 versus B_1 , must be of an elementary nature to him, if he is fitted for his post. Hence we may call the engagements A_1 versus B_1 , etc., the elementary contests of the battle.

Let A_1 be superior to B_1 . Then we know that A_1 has means to bring its advantage home. B_1 is therefore under a pressure which finally would force it into a fortified position or to flight, unless the regard for its comrades influences its actions. If its conduct were egotistical, the effect of A_1 , absorbed by B_1 , would become free to direct itself against B_2, B_3, \dots and force a new alignment of the troops, greatly to the detriment of the B party.

B_1 therefore must not only sustain the pressure of A_1 but also exercise a function for the benefit of the whole.

A_1 is equally restrained. Should it do no more than use its advantage against B_1 in a eumachic manner without regard to anything else, its superiority would be brought home too late or not incisively enough. A_1 must therefore also obey an

altruistic restraint which depends, in its character, on the exigencies of the situation as a whole.

A₁ having the advantage against B₁, unless B₁ retires or changes its position, support must be brought to it whenever A₁ engages its forces to their utmost capacity. In the elementary fight, A₁ versus B₁, the A party has therefore a "threat" against the B party, and it is one of the functions of B₂, B₃, etc., to parry that threat.

In consequence of the various threats and counter-threats, manoeuvres must be executed, to attack, to ward off, to prepare etc.

Every manoeuvre is composed of a series of small ones, and each small manoeuvre consists of the hundred parts due to the activity of A₁ A₁₀₀. or B₁ B₁₀₀. and therefore called elementary. If the contest between A₁ and B₁ evolves itself according to its own laws, it is called "natural." This word is always used to denote that a well-known process is progressing along normal lines. But if by an accident, or by an extraordinary effort or by an unforeseen manoeuvre the natural evolution of the elementary contest is in any way impeded there must be a sharp discontinuity in the small elementary manoeuvres of A₁ and B₁, of which information will immediately be sent to the general.

To understand the difference between natural small manoeuvres and others, let us investigate small manoeuvres more thoroughly.

With every small manoeuvre there corresponds a small exertion. If muscles are moved the heart is fatigued in proportion to the expenditure of muscular energy. If the attention is directed toward a definite aim, it takes time and costs nerve strain to pursue another aim. In firing the stock of shell is lowered. If one approaches the enemy, the effect of his fire becomes larger. If one side becomes more visible to the foe, the enemy can shoot with greater

exactitude. When a manœuvre is executed a physical effort is made, the effect of the opponent grows a little in the course of action and lastly the means for effect are consumed. The sum of all this is designated by "exertion." To measure it, we must return to the conception of "capacity." The capacity of a man armed with gun, bayonet, shells, etc., is comparable to that of another who is similarly armed. It is measureable as a quantity. It depends on several factors such as freshness, number of shells, position in the field, etc., and also varies with the time, Mathematicians would say that it is a "function" of time and several other quantities. An exertion decreases the capacity of the party that makes it and heightens that of the other. The measure of one's exertion is the resultant increase of the enemy's capacity plus the decrease of one's own. It is therefore a quantity dependent upon time and several other factors that might be enumerated and independently measured.

This change of capacities is accompanied by a change of effects. If one has approached the enemy, one's own effects, and that of the foe, increase. If one has sought cover, the hostile effect is minimized. In a flanking position the probability of hitting is considerably greater than in a frontal position, because the bullets traverse a space more full of suitable aims.

The total result of a small manœuvre is, therefore, that at an outlay in capacity one's effects grow, hostile effects are undone and, at any rate, effects are changed.

A manœuvre is always natural if with a comparatively slight exertion a favorable change in effects is produced. But not every eumachic small manœuvre is natural in this sense. If a squadron attacks a battery, the cavalry suffers at first immensely. The cannon balls cause a veritable slaughter among it.

But when it arrives at the guns, the battery is lost to the enemy. The gunners are helpless before the lance or sabre. It is true that, in order to find the gain in effect accruing to the battery during the ride, one must know what effects it has had previously. But in any case, it is evident, that small manœuvres, to be eumachic, need not immediately repay in effects what they cost in exertion. Potential effects that finally may be realized have to be taken into consideration.

These potential effects are frequently overlooked or wrongly calculated but they are by no means mystic or miraculous things that only a genius can comprehend or, as some imagine, suddenly conjure up, but they are things that can be reasoned out. A potential effect presupposes a large value located so that it cannot be reached with slight exertion nor without traversing a zone of large pressure. When a ship has stranded we want to throw it a line, so that the men on board may safely come on shore. If the line does not quite reach the ship, it is no good for its purpose. A mere approach towards the effect is no better than to make no effort at all. Similarly, in a machée, a potential effect is one which gives no returns for initial exertions but suddenly yields a valuable compensation the moment that a certain point is reached. It is due to a weakness that is strongly guarded and which may be conquered by a great exertion or cannot be harmed at all. It is a fortress with invisible walls within which great machic values are stored up, an easy prey to one inside.

If the process of decomposition of the machée can be understood, if the natural progress of the struggle can be surmised, if the functions to be fulfilled by the various departments of the army can be ascertained, if potential effects can be measured, the force of the jump and the value of the price can be

calculated, there still remains one thing to be studied, which depends on all of these circumstances collectively and which links them together by an intellectual chain. That is the plan which the general follows. Why does he reject one proposed plan immediately? Why does he think another feasible? Why does he select a third one as a guidance? This is the question that remains to be answered.

Unless the definition of "plan" is narrow, it cannot be very definite. The plan of a battle is the logic of the sequence of its events. The plan of a piece of writing makes itself felt in its fluidity. We speak of a color scheme meaning thereby the intent with which the colors are arranged. The plan is formed by this process. The analysis of the situation is interpreted by the general so as to create a desire in him in accordance with which he sets himself a task that he considers solvable. The plan of Hannibal at the battle of Cannae, for instance, was due to his belief, that his infantry could sustain the shock of the Romans longer than the Roman cavalry could withstand his attack. His desire was therefore to engage all the hostile infantry with his, to quickly disperse the Roman cavalry and attack with his horse in the rear while the hostile infantry was still fully occupied with the fight in front. Had the Romans kept reserves, or if they had thrown the Carthagenians into confusion before the cavalry duel had been decided, Hannibal's plan might have failed. Julius Caesar at Pharsalus was in the same predicament as the Romans at Cannae but he had two thousand sturdy Germans ready to receive the charge of the horsemen of Pompeius, and he gained a decisive victory.

The plan of a machée is akin to the "idea" of a work of art or the "plot" of a play. It is the working out of a desire springing from a "motif" based on analysis.

The plan determines a series of tasks that on account of the logical connection between them form a program. It is not every task that A sets himself which is a link in the chain that constitutes his plan. The contest between A₁ and B₁ has its special tasks, which are of an elementary nature and are logical consequences of the situation between the two opposed groups. But if the manoeuvres in this partial fight cannot be explained by the exigencies of the combat between them, they are hints that a function has been assigned to A₁ and B₁ outside of their natural function to oppose each other. If, for instance, A₁, though superior to B₁ beats a retreat, this manoeuvre points to the plan of the A party to execute important aggressive operations in another part of the field or to retire altogether. Or if A₁ makes an energetic assault on B₁, the A party wants to force its antagonist to bring succor to B₁ and thus to weaken the B₂.....B₁₀₀ composed of reserves and actively engaged forces. Thus each manoeuvre tells a story to the observant eye of the general. And it is this very fact which permits us to bring out the characteristic feature of the plan which a macheeide would form.

The macheeide has the ability to read the plan of its opponent and the desire or motif underlying his plan, from his manoeuvres. The hostile manoeuvres speak to it a language that it understands. They are as an argument made by the foe that it can comprehend and to which it replies by its own manoeuvres..

The language of the manoeuvres of a machee, like a language that is spoken, has a vocabulary and a grammar. Every elementary manoeuvre is a word, a sequence of such manoeuvres, a sentence expressing an idea. As in the literature of many languages the same ideas and the same combinations of ideas recur, the same sentences may be found in the most

varied machees. These sentences are expressed in fundamentally the same manner. To make this evident, it is necessary to put aside all unessentials and to consider only the characteristic conditions of a machee.

These characteristic conditions can be detected by an investigation of the weaknesses of the armies, the effects of the stratoi and the pressure on the points of the machic field.

A weakness is a sum of capacity, which in the form of stratoi is so placed as to invite attack. The weakness is under pressure which is small, if the exertion, to assail it, is large. The pressure of a stratos on a point is indirectly proportioned to the exertion that the stratoi must make to produce the unit of effect on the point. .

The pressure of various stratoi on a point cannot, it seems to me, be more than the sum of the pressure exerted by the stratoi individually on it, but it may be less, because the stratoi may hinder each other in their effects.

A sharp distinction must be made between pressure and effect. An "effect" is always a lowering of the hostile capacity by force. It makes no difference how this end is attained. The effect may be temporary as well as permanent. It may grow or lessen in time. If a point is unoccupied by a hostile stratos, no effects can be gained there. But the pressure on that point exists and may be the reason, why the enemy does not occupy it. To traverse zones of great pressure entails loss in machic energy and would not be justified unless by a corresponding gain in effect or potential effect.

There is no reason why a perfect brain should not be able to calculate the magnitudes referred to. Even if we cannot do so at present, we can, at least, come near the truth. In the great number of machees that are known to us—the arts, the sci-

ences, the struggles of life, warfare, athletic games, chess, etc.—the brain that has to perform the task of the general develops, as its experience and skill grow, an aptitude that we call “judgment” which permits a quick and yet fairly exact estimation of these values. There is nothing absurd in the conception that this judgment may become as perfect as it is in the macheeide. It is therefore not illogical to assume the **existence** of these values as mathematical quantities. And this assurance suffices us.

Supposing that the values of weakness, pressure and effect are known and that the alterations of these magnitudes by all the possible manoeuvres are as exactly fixed, a dictionary or a telegraphic code of manoeuvres may be written that will equally apply to all machees, of whatever nature they might be.

Here follow some sentences with their translations into the language of manoeuvres.

The construction of the code of manoeuvres is founded on the following considerations: Effects cannot be produced before pressure has been concentrated on weaknesses. The intention of making an attack can therefore be concluded from exertions, however slight, that would be unnecessary for purely defensive purposes and aim at increasing the pressure on hostile forces. The objective point of an attack is usually not determined upon in the early stages of preparation for it. Frequently, either party has to choose between alternatives. An operation which prepares for possibilities has, therefore, an indefinite character. Its purpose is to increase the pressure on various points at once. The most indefinite preparation is development of force, or organization. The corresponding spreading of pressure of the principal points on the field is then nearly equable.

Hence it is clear that the intent of aggression can be discerned at its very inception.

The defender, does not desire a change in the position. He would be satisfied, for the time being at least, if neither side made any exertion. But he may foresee that his opponent will attack and force him to retreat. He therefore prepares for resistance if he sees an advantage in causing exertion or delay to his opponent, and is careful to execute his retreat with a minimum of loss. Thus the attitude of the defender is fully explained, and the meaning of his manoeuvres, varied as the circumstances might be, can be determined without ambiguity.

The laws of balance and superiority tell us when an attack might be successfully undertaken and when not. Where the position is balanced, each attack admits of a sufficient defense. The intent to attack, if clearly defined, is in such situations, therefore, an indication of a strategic mistake. It may be a bluff intended to deceive the opponent, or it may be due to lack of judgment. In the first case, the bluff will have to be given up, if the opponent disregards it and utilizes the time for vigorously advancing his aims. In the second case the attack should fail on account of a counter-attack.

From these hints, it is manifest, how the correspondence between sentence and manoeuvre that here follows has been compiled.

I develop my forces. Manoeuvres that aim at spreading the pressure on the field in equal proportions.

I attack the weakness W. Heaping of effects upon W.

I shall attack W. Heaping of pressure upon W.

I put myself into a state of defense. The greatest weaknesses occupy places of least pressure. The line exposed most to the hostile effect has very

slight weaknesses, is difficult to recognize and very mobile.

I threaten to annihilate the force F. Heaping of so much pressure on F that a very slight exertion suffices to annihilate the force.

Your threat is only "bluff." Tranquil continuation of development, or complete tranquility, in spite of the gathering of hostile pressure upon a weakness.

I ward off your threat by flight. Movement of the threatened weakness to a place of lower pressure.

I brave your threat. Maneuvers which increase the effort that the enemy must make to execute his threat.

If you execute your threat, it will be to your damage. A counter-threat upon a weakness of the foe whose parry is impossible without the use of forces that he had determined for the attack.

I want to attack you. Concentration of pressure upon a large number of hostile weaknesses

You have no right to expect that your attack will succeed. Development accompanied by a slight concentration of pressure on hostile weaknesses.

My attack is in advance of yours. Preventing the enemy by counter-attack from heaping pressure on weak forces.

You are stronger than I. Flight movement to places of lower pressure.

I give way, but take care. Flight with little exertion during which time pressure is concentrated upon points whence the enemy could exert great pressure.

I shall attack you later. Operations that aim at the decrease of the hostile armooestia, for instance by the formation of a coherent region of pressure.

Perhaps I shall attack you. Occupation of points of low pressure by stratoi of small value which would there exert relatively large pressure.

I shall later defend myself without abandoning my position. Decrease of future pressure by the formation of a defensive wall.

I shall sustain your attack for a time. Points whence large effects may be produced, are occupied by very mobile stratoi.

I intend to give way. The stratoi of small armoostia are sent into distant points of low pressure.

I stake everything on this one chance. Considerable concentration of pressure on a weakness, although the operations necessitate traversing zones of large pressure. Future hostile threats are wholly ignored.

I have as much right as you. Imitation of the enemy's maneuver under similar conditions.

I have more right than you. Imitation of the enemy's maneuver under more favorable conditions.

Your attack has failed. Stratoi that exert great pressure are forced to retreat.

My attack has failed. The stratoi, which exerted great pressure, retire to points of slight pressure.

I fall, but I sell my life dearly. Effects are directed against stratoi exerting great pressure. No retreat.

I am desperate. Take care. Aggressive movement or some other preparation for attack against a superior opponent.

You are lost. I need not assail you. The armoostia of the enemy is nearly exhausted. A defensive position is occupied.

You must attack me or you are lost. Operation that considerably lowers the armoostia of the opponent.

Your success is insignificant. Continuation of the combat after the loss of a weakness.

The success at which you aim has very little value. No aid is given to the assailed weakness, but the highest possible compensation is obtained for it. Energetic pursuit of a counter-attack.

A is not stronger than B. Let us compare them. B and A engage each other. No side retires from the field.

I admit that A is stronger than B. Parry of a threat by A against B by the aid of auxiliary force or by flight of B.

I am not interested in the question whether A is stronger than B. B defends itself against an attack of A, but makes no exertion to attack A.

I will annihilate you altogether. Operations that are intended to completely exhaust the armoostia of the opponent.

I will force you to beat a retreat. Concentration of pressure on the enemy's position, but none upon his line of retreat.

I will cause you heavy losses. Concentration of pressure upon the hostile force while simultaneously his line of retreat is put under pressure.

You are stronger than I, but you have no right to expect what you do. Occupation of places of a fair amount of pressure as preparation for an attack, although one is evidently weaker than the enemy. The object of this attack are those forces which want to occupy very threatening positions.

The moment is favorable. One makes great exertions. Pressures and weaknesses are large.

The critical moment has not yet arrived. One makes small exertions. Pressures and weaknesses are small.

The crisis is approaching. Occupation of places of small pressure whence with no great exertion effects can be produced.

I know that my position is hard to maintain but I shall do my best. Laborious defense. Very slight counter-attack. Retreat whenever stratois are not obliged to expose themselves to effects for the sake of shielding great weaknesses.

These instances may easily be added to. But the variety of positions and manœuvres is such that to write an exhaustive grammar of the language of manœuvres would be a task of considerable difficulty at least.

Everyone has an elementary knowledge of this language. Boys learn to speak and read it in their fights. Girls know how to interpret the discreet acts in which kindness and malice, adoration and aversion indicate themselves. Animals are quick to discern the meaning of movements and situations. Every species of struggle has its own code of signalling. Among pistol-fighters, for instance, the throwing up of the hands and the grasping movement towards the hips are well understood as surrender or threat.

If we interpret the manœuvres of a machede, as they succeed each other, it is as if we read a discussion or an argument. In it statements of fact are made, possibilities are hinted at, accusations are hurled by the opponents against each other, questions of superiority are raised and decided, demonstrations are attempted and mistakes are shown up. Even very subtle moral questions are discussed and decided, strange as this may appear at first sight. All morality is based, in the last analysis, on the essential equality of beings of the same class and order of life, and on the preference that effort and capacity deserve. In the involved arguments of a machede, a point is finally reached, where a question of balance and advantage, or one of magnitude and nature of an advantage has to be settled. Thus a dispute before

a judge decided on moral grounds and the interpretation of the happenings of a machee run on parallel lines.

Let us now return to the machee on the battle field, and let us imagine a judge, whom we may call Macheus, an entirely ideal personage which is fitted for his office with the perfection of a macheeide. Let it be the task of Macheus to follow the argument expressed in the language of manoeuvres and to give his decisions by granting successes and victories to the contending parties.

Macheus is identical, if we so want to express it, with the laws of the machee over whose happenings he presides. He is the totality of those laws personified. But they include the principle of balance and advantage and the laws resulting from it. Macheus must therefore be guided by moral principles as may be shown by the reasoning previously employed. And he is logical, because to allow an incongruity in logic would be equivalent to preferring a liar, which would be immoral.

The plan of the general must, consequently, be so conceived as to be able to stand the scrutiny of the infinitely logical and just Macheus. It must be logically consistent and objective.

This embodies the principle of logic and justice.

We may draw another important conclusion from the above considerations. He who employs force or wants to constrain, he who asserts himself in any way, encounters the instinct of justice, that immediately accuses him of seeking undue preference. Thus in the argument before Macheus the aggressor of the machee must defend himself. His defence is expressed in the language of manoeuvres that alone can be used before Macheus. Hence it follows that the attack of a macheeide must clearly indicate, not only that there is an advantage on which it rests, but that the method of the attack

is commensurate with and related to the nature of that advantage. The "motif" of the advantage must be reasoned out by the general, and his aggressive manoeuvres must, step by step, be in unison with it. Moreover, as the aggressor of the machee is a defender before Macheus he must so choose his manoeuvres as to conform, in the machee before Macheus, to the principles of defense previously laid down. The macheeide defender, after having assumed the position of greatest safety, is always economical in his exertions. He makes no effort, unless obliged to do so, and then gives way to force only in proportion to its intensity. Hence the attacker, after having chosen the plan that seems to him most just and logical, should not change it, unless the arguments of the defender before Macheus force him to do so. And then he should so proceed as to convey in the most economic terms, the most incisive answer to the objections raised by his opponent.

There is a proverb: "God's mills grind slowly but exceeding fine." This affirms that events in the struggle for life conform to a principle of justice which slowly works out its course.

Commerce brings things whence they are plentiful to where they are needed (Emerson). A business has a *raison d'être* only in so far as it is commercial. (Principle of work and of justice). And it is enduringly profitable only to the extent to which it demonstrates that usefulness, (because the advantage gained by an attack is proportionate to the initial superiority of the aggressor). The businessman who wants to obtain more than the objective value of his work, is as the general who expects too much from exploiting a little weakness of the enemy. The exaggeration of their desires becomes disastrous for both.

An orator must have a message. (Elbert Hubbard). He must not attempt to create interest. The auditors must have interest from the outset, but the orator must mould the raw material. He must say something new and essential with every sound that he utters (Principle of work). He must order his thoughts so that the flow of ideas that he produces in his audience, is harmonious (Principle of economy). He must reserve his emphasis and his rhetorical art for those points where the subject is of the greatest interest, and he must neither avoid nor exaggerate the opportunities to fire the imagination of his auditors. (Principle of justice).

Our physicians and teachers are substitutes for organs that nature has as yet not had time to develop. A man living in a simple environment has a physician in himself. While he sleeps or rests, a very wise, skillful and versatile strategian recognizes all weak points in his body and repairs them. The

physician organ in the body is always awake and active. It makes the invasion of hostile bacilli difficult, combats them when they gain entrance and prepares an antitoxin to annihilate reinforcements of the foe. It is not easily roused to violent measures but when it decides on them it concentrates all its available force, and in a courageous onslaught, while the body is bathed in fever sweat and the brain dispenses with its critical faculty, it uses all its resources to come out victorious. It is conversant with the treatment of illnesses to which previous generations had been subject. It knows how to cure skin diseases, the scourge of our ancestors. It heals all wounds that are not produced by weapons. When men are assailed by a new sickness, it learns by slow degrees how to treat the evil. The disease loses in time its virulence and becomes enfeebled.

It has slight regard for the individual but it carefully watches the interest of the race. It prompts the individual to fight a foe of the race with the utmost endeavor. Thus it acts as the guardian of the interests of all. It is a very wise altruism that it practices because in the battle incessantly fought by the race against environment and bacteria it is a strategical necessity that the members of the race should offer a united front to the enemy.

But with situations new to the race it does not know how to deal. That is why in the complex conditions of modern society we need physicians.

Our most competent doctors follow the tactics of the physician organ. They esteem it as their strongest ally and in the majority of cases they simply produce the environment that it knows and let it do the rest. But the doctors who want to impress the multitude which is unfortunately guided by a romantic sense responsive to superstition,

myth, miracle and the incomprehensible, behave as that antipodean to the true strategist, the maneuverist. They promise to conquer the illness by cleverness, not by effort. According to them the patient needs only to take a little of some strange mixture and his enfeebled organs and disorganized cells will resume their normal condition.

There is in human nature, generally, more of the fool than of the wise, and therefore those faculties by which the foolish part of men's minds is taken are most potent (Bacon, on Boldness).

Our greatest medical sin is vaccination. It is founded on bad strategy and even bad logic. By vaccination a serum is formed that remains in the veins and wards off the attacks of smallpox. But the result is achieved at frightful cost. The initial operation maims many children and the smallpox serum has no "armoostia" against any disease but smallpox. Hence the body is permanently weakened against a score of illnesses to forestall one. Tuberculous bacilli in particular profit by the act. Possibly the increase of consumption is due to vaccination. The proceeding is contrary to the principle of economic defense. And it is illogical, because the principle of the cure of any one infectious disease must apply to others to be logical, but no conscientious physician would advise vaccination as the proper treatment against, say, six potential illnesses. A body so maltreated would be unable to withstand a mere cold.

The question what the correct strategy against an infectious disease is, can be answered in general outlines. The "wall" against it is sanitation. If the enemy breaks through, we need a scouting ser-

vice to convey the information. But society has not organized it. Children should be taught at school to measure their weight, to count their pulse beat, to determine their blood temperature, and, generally, to find by simple means whether their condition is normal or not, and in which direction it is abnormal. To educate the nation in this respect is worth some trouble, were it only that every one would be enabled to discern the immediate effect of dissipation and overwork. It is only after an intelligent information has reached the physician that his aid can be of value. He has to analyze the danger as the defender analyzes the threat, and then parry the blow, preferably with a minimum of means and in the nick of time.

In this way he defends the race against its enemy according to the principle of economy.

It is difficult to conceive that sanitation should be ineffective against smallpox and that vaccination should have to be resorted to as the widest line of defense compatible with safety.

The brain has an instinct that acts as teacher. The whole development of the human race in olden times was due to it. Prometheus was invented to personify it. We might identify it as memory plus imagination. Environment sets a task, man must make a strong effort to solve it—perhaps his food supply is dependent on his ability to cope with the situation—he sets his imagination at work, tries, and memory records the result. A large number of related events teach an unforgettable lesson. The process passes through three stages, desire, effort, memory. Our best teachers are content to represent in the above formula the environment that sets the problem. If necessary, they aid in the process by pointing out where the effort has failed. To create in the pupil the desire

to overcome an obstacle is a task whose solution entirely depends upon his psychology, and is therefore very variable. But the law to be followed is always the same; the teacher, as the artist, must not waste interest. He must be economical in his calls on attention. The teacher must use persuasion only where the artist would be emphatic. They both must be exceedingly economic in the means they use.

It is very doubtful whether our teachers in the public schools or colleges come near the ideal. What they accomplish does not appear to be proportionate to the time used and the exertion that they demand. Our young men after having gone through a drill of twelve years seldom know their own language. And in mathematics and physics they are wrecks. They have been given unnatural problems to solve, they have been taught unnecessary matter and as a result they fancy that skill in mathematics is shown in the ability to solve freakish puzzles, and that mathematicians are men with a wonderful gift to remember strange formulae, and to make long calculations. Of the harmony in thought, of the power and adaptability and of the true aims of mathematics, they are entirely ignorant.

The unfortunate result of our teaching of physics is that the ideas of our young men in regard to properties of matter and the acting of forces become fixed. The pliable and highly imaginative brain of a young man eagerly assimilates a theory that explains a phenomenon in terms of concrete pictures. The theory of the two electrical fluids, for instance, appeals with such force to the imagination of a young learner, that it becomes a matter of firm belief, and he would consider an attempt to give another explanation as almost heretic. The

true physicist looks upon an hypothesis as only an aid to memory or, at best, a stimulus for invention. He sharply distinguishes between axiom, deduction, experimental fact and assumption and thereby learns how to value them correctly. The fluidity of his physical ideas keeps his interest always awake, while the rigidity of the few formulae, that the average man learns at school, in satiating his sense of the mysterious, deadens his desire to search.

It is the function of music to bring into commotion the wishes and fears stored in our mind. While they move they generate in us a series of impressions, acting as the phonograph, which, once sound has left an impress on the cylinder, can reproduce the sound at any time. In this way music makes our organ of wishes and fears invent a story for our delectation. There are laws governing the relation of the story to the musical piece. Harmony lets the story evenly progress, discord creates contrary wishes, and is felt as complexity or conflict. The melody is the theme of the recital, the common factor, as it were, of the sounds composing the piece. The volume of sound is the natural expression of the intensity of the corresponding mental impress. The connection between a piece of music and its unconscious interpretation by the mind is dependent on many other factors than those enumerated, and has to be studied in detail. But whatever these factors may be, we know that certain principles of strategy must prevail in the composition of macheeide music. The conflict of disharmony must be logically told to a conclusion, as a story with a villain and a hero. Emphasis must not be used in vain. There must be justification and proportion for it. No undue preference must

be shown by the composer. Such is the demand of the principle of justice.

In the best criticisms, these principles are given expression in one form or another. Lawrence Gilman, for instance, says of Claude Debussy on page 878 of the *North American Review* of 1906:

"He exhibits an abhorrence of the commonplace of the easily achieved . . . he does things that, for those whose chosen or hieratic function it is to uphold the elder codes, seem little short of anarchistic. Yet, when his idiom is comprehended, one becomes aware of a delicately inexorable logic".....

There is then, according to the critic, a language in music which can express musical thoughts logically or otherwise, whose utterances may be trite and commonplace or profound. In speaking of *Pelleas et Melisande*, the same writer says....."in listening to his music one catches oneself imagining that it and the drama issued from the same brain. Not only is it impossible to conceive of the play wedded to any other music; it is difficult, after hearing the work in its lyric form, to think of it apart from its tonal commentary.".....The determinateness of macheeide action is here musically confirmed. On another page one reads: "His orchestra reflects the emotional implications of the text and action with scrupulous fidelity, but suggestively rather than with detailed emphasis. The drama is far less underscored than with Wagner; the note of passion or of conflict or of tragedy is never forced. His personages love and desire, exult and hate and die with a surprising economy of vehemence and insistence.....Yet, unrhetorical as the music is, it is never pallid; and in such truly climactic moments as that of Goloud's agonized outbreak in the scene with *Melisande*, in the fourth act, and the ecstatic culmination of the final love scene, the music supports the dramatic and emotional crisis with superb

competency." The critic here praises the economy, and points out the justice of Debussy's work.

The parts of a judge in hearing are four; to direct the evidence; to moderate length repetition or impertinency of speech; to recapitulate, select and collate the material points of that which hath been said, and to give the rule or sentence (Bacon, on Judicature). The first is the office of the critic, the second, the enforcement of the principle of economy, the third applies the principle of value, and the fourth is a task to be executed in conformance with logic, justice and the written law.

SUFFICIENCY OF THE LAWS

The results at which we have arrived suffice to show in which manner the events of a machee are subject to reason and, however ample the task of the general might be, how he has to proceed to do it justice. We have shown that development of force should tend to exert additional pressure on the field, and to make, with a minimum of exertion, the armoostia a maximum. We have proven that an attack must be based on an advantage and that, inversely, an advantage calls for an attack. We have explained that the essential character of defense is its economy, that it therefore must always act in the nick of time—not before, nor after—and with barely sufficient means. We have introduced an ideal, the infinitely logical and just personage Macheus, who in life is felt as the critical conscience of the machee and before whom the aggressor of the machee must clear himself, in the code of manoeuvres, from the charge supported in the same code by the defender of the machee of being, in some definite way, unjust or illogical in his claims. We have seen that with the machee on the field there corresponds, step by step, an action before Macheus. To apply these ideas in our struggles, we have to study the code of manoeuvres of the machee in detail as we might study a language, and then conduct our case before Macheus as we would one before an unbribable human judge.

If we do so, we shall finally achieve the best results that we can accomplish, because *no law can be valid in a machee that is not capable of logical deduction from the laws stated in this book*. This can be shown by rigorous reasoning. Every manoeuvre, to be of service, must accomplish work, or it would be

contrary to our principle of work. It must therefore change the various values of pressure in the field and, in accordance with the considerations of the last chapter, must be developing, or aggressive or defensive in each point. The field may therefore be parceled out into zones, where the manœuvre is either the one or the other or the third. But we have laid down the laws for development, defense and attack. Hence, if we give the problem sufficient study, we can compare the merits of planned manœuvres, and comprehend their nature when made. However difficult this task might be, we need at least not fear that a mystic force, or any force whatever, with which we have here not become acquainted, decides the issue.

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